SOIL SURVEY OF

Chambers County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1963–69. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Trinity Bay Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in determining the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Chambers County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit, the pasture and hay group, the range site, the woodland group, and the woodland grazing group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units, the pasture and hay groups, the range sites, and the woodland groups.

Foresters and others can refer to the section, "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Engineering Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Chambers County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: **Leveling an area of a Lake Charles clay for rice irrigation and drainage.**

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SOIL SURVEY OF CHAMBERS COUNTY, TEXAS

BY JACK D. CROUT, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

CHAMBERS COUNTY is in the extreme southeastern part of Texas (fig. 1). It is bordered on the south by Trinity Bay, Galveston Bay, East Bay, and the Gulf of Mexico. Jefferson County is on the east, Liberty County on the north, and Harris County on the west.

Chambers County covers a total area of 560,000 acres, of which 381,517 acres is land and 178,483 is water. The area is a nearly level, featureless plain that has very little dissection, although the Trinity River and several bayous that have shallow channels furnish some drainage. Anahuac, the county seat, is located at the head of Trinity Bay.

Farming is of foremost importance. Rice is the principal crop, and most of the cultivated land is in the prevailing rice-pasture rotation system of farming. Some corn, grain sorghum, soybeans, hay, and other livestock feed are produced in some of the better drained areas. Ranching and timber production also are important to the economy of the county. Production of petroleum and petroleum products is a major industry. Gas, shells, and sulfur also are produced in the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Chambers County, where they are located, and how they can be used. The soil scientists went into the county expecting to find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles (fig. 2). A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

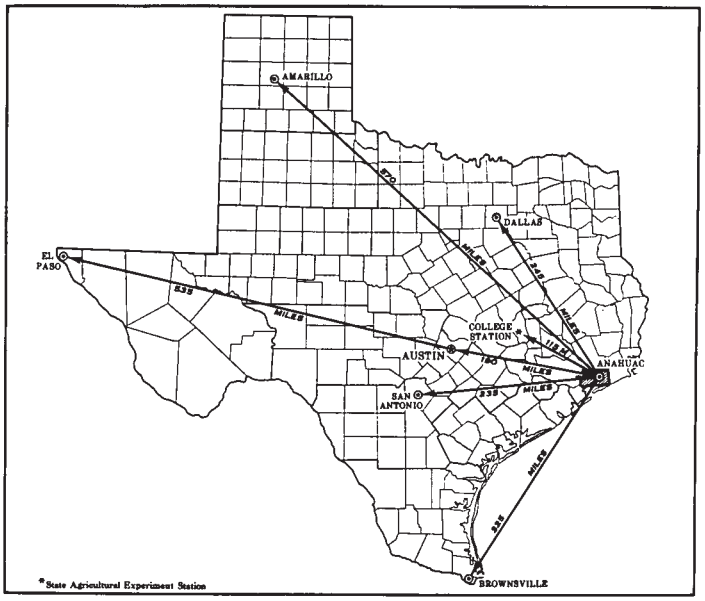

Figure 1.—**Location of Chambers County in Texas.**

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Beaumont and Anahuac, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Lake Charles clay, 1 to 5 percent slopes, is one of several phases within the Lake Charles series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not

Figure 2.—**Profile of Anahuac silt loam.**

exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such mapping unit, a soil complex, is shown on the soil map of Chambers County.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Frost-Morey complex, levelled, is an example.

In some places the soil material is so variable that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are named from the suborder in which the soils are classified, for example, Psamments.

While a soil survey is in progress, samples of soil are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used both as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Chambers County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different proportion and pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large areas that are suitable for a certain kind of land use. Such a map is not suitable for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the soils in any one association ordinarily differ in slope, depth, drainage, and other characteristics that affect management.

The six soil associations in Chambers County are discussed in this section.

1. Beaumont-Morey-Lake Charles association

Acid to neutral, clayey and loamy soils

This association is level or nearly level and has few natural drainageways. Water stands for long periods after heavy rains. Beaumont and Lake Charles soils

are in the wider, more nearly level areas of the association, and Morey soils are in the slightly higher areas.

This association makes up about 57 percent of the county. Beaumont soils make up about 49 percent of the association, Morey soils 28 percent, Lake Charles soils 21 percent, and minor soils 2 percent (fig. 3).

Beaumont soils have a surface layer of mottled, dark-gray clay about 22 inches thick. The next layer is 26 inches of dark-gray clay that has brownish-yellow mottles. The underlying material is mottled, gray clay that extends to a depth of 72 inches.

Morey soils have a surface layer of very dark silt loam 9 inches thick. The next layer is 3 inches of very dark gray silt loam over mottled, dark-gray silty clay loam that extends to a depth of 32 inches. Below this is mottled, grayish-brown and gray silty clay loam that reaches to a depth of 64 inches.

Lake Charles soils have a surface layer of black clay 36 inches thick. The underlying material is very dark clay that reaches to a depth of 64 inches.

Minor soils in this association are the Anahuac soils in higher areas and the Frost soils in depressional areas.

This association is used mainly for crops and grazing. The soils are well suited to crops, pasture, range, wildlife habitat, and trees. Some areas are in timber. The water supply for irrigating crops in this association comes from the Trinity River and from major bayous through an extensive system of canals. The average farm is about 200 acres in size. The land is farmed by both owners and tenant farmers.

2. *Harris-Veston-Ijam association*

Alkaline and saline, clayey and loamy soils

This association is near sea level and has few natural drainageways. Harris soils are on broad flats and are covered with coarse, salt-tolerant vegetation. Veston soils are in slightly elevated areas near the Gulf and bays. Ijam soils are on slightly elevated spoil banks that were created as the Intracoastal Canal was dug or dredged out.

This association makes up about 16 percent of the county. Harris soils make up about 76 percent of the association, Veston soils 6 percent, Ijam soils 3 percent, and minor soils 15 percent (fig. 4).

Harris soils have a surface layer of very dark gray clay about 19 inches thick. The next layer is mottled, dark-gray clay 25 inches thick. The underlying material is mottled, gray silty clay that extends to a depth of 60 inches.

Veston soils have a surface layer of dark-gray silt loam 8 inches thick over 4 inches of very dark gray silty clay loam. The next layer is mottled, dark-gray and gray silty clay loam that reaches to a depth of 63 inches.

Ijam soils have a surface layer of dark-gray clay 8 inches thick. The underlying material is mottled, dark-gray clay that extends to a depth of 62 inches.

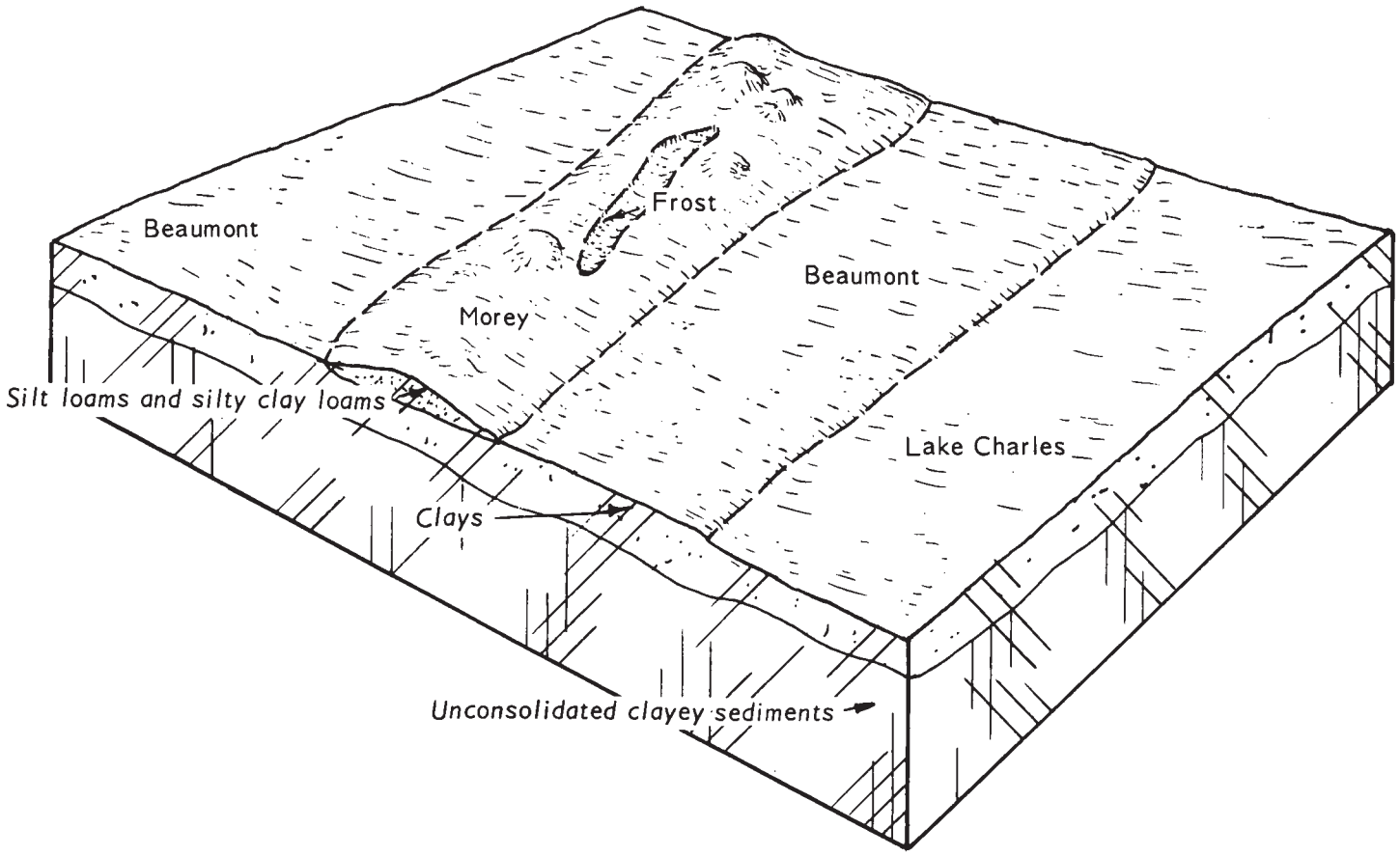

***Figure 3.*—Pattern of soils and underlying material in Beaumont-Morey-Lake Charles association.**

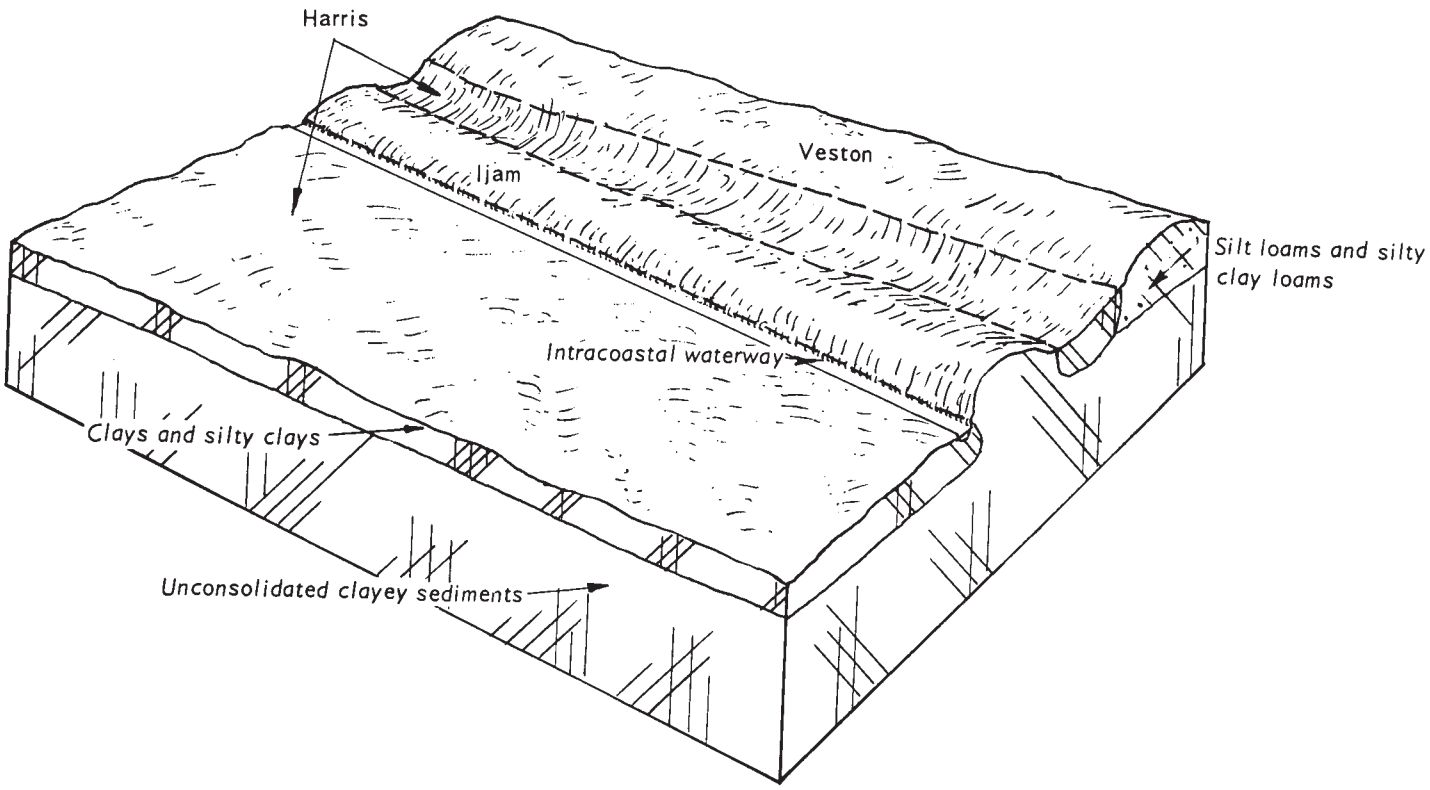

Figure 4.—**Pattern of soils and underlying material in Harris-Veston-Ijam association.**

Most of this association is in large ranches. The soils are well suited to range, wildlife habitat, and recreational uses.

3. *Anahuac-Morey-Frost association*

Acid loamy soils

This association is made up of nearly level areas of Morey soils; slightly elevated, ridgelike areas or large circular mounds of Anahuac soils; and depressional areas of Frost soils. There are few natural drainageways.

This association makes up about 13 percent of the county. Anahuac soils make up about 42 percent of the association, Morey soils 35 percent, Frost soils 19 percent, and minor soils 4 percent (fig. 5).

Anahuac soils have a surface layer of silt loam about 18 inches thick. It is very dark gray in the upper part and very dark grayish brown in the lower part. The next layer is 10 inches of mottled, brown silt loam. Below this is 34 inches of mottled, dark-gray and grayish-brown silty clay. The underlying material is mottled, light brownish-gray and yellowish-red sandy clay loam that extends to a depth of 74 inches.

Morey soils have a surface layer of very dark gray silty loam about 9 inches thick. The next layer is 3 inches of very dark gray silt loam over mottled, dark-gray silty clay loam that extends to a depth of 32 inches. Below this is mottled, grayish-brown and gray silty clay loam that extends to a depth of 64 inches.

Frost soils have a surface layer of silt loam about 12 inches thick. It is dark gray in the upper part and gray in the lower part. The next layer is mottled, gray silty clay loam that extends to a depth of 54 inches.

Minor soils in this association are the Beaumont and Lake Charles soils, which are in level areas that are lower than areas of Morey soils.

The soils in this association are suited to crops, range, pasture, wildlife habitat, and recreational uses. Morey and Frost soils are used mainly for irrigated crops. Anahuac soils are not used for irrigated crops in most places, because land smoothing is difficult and lift pumps are needed for irrigation. Most farms are about 50 acres in size and are farmed mainly by owners; few are farmed by tenants.

4. *Vaiden-Acadia-Calhoun association*

Acid, clayey and loamy soils

This association is in nearly level or depressional areas. Water stands for long periods after heavy rains. Some gently sloping areas lead to low terraces of the Trinity River and to other natural drainageways. There are several large natural drainageways. The clayey Vaiden soils are in the wider, more nearly level areas and have the steepest slopes in the association. The loamy Acadia soils are on slightly elevated ridges and at the top of the steeper slopes. The Calhoun soils are in depressional areas.

This association makes up about 6 percent of the county. Vaiden soils make up about 68 percent of the association, Acadia soils 14 percent, Calhoun soils 11 percent, and minor soils 7 percent (fig. 6).

Vaiden soils have a surface layer of mottled, very

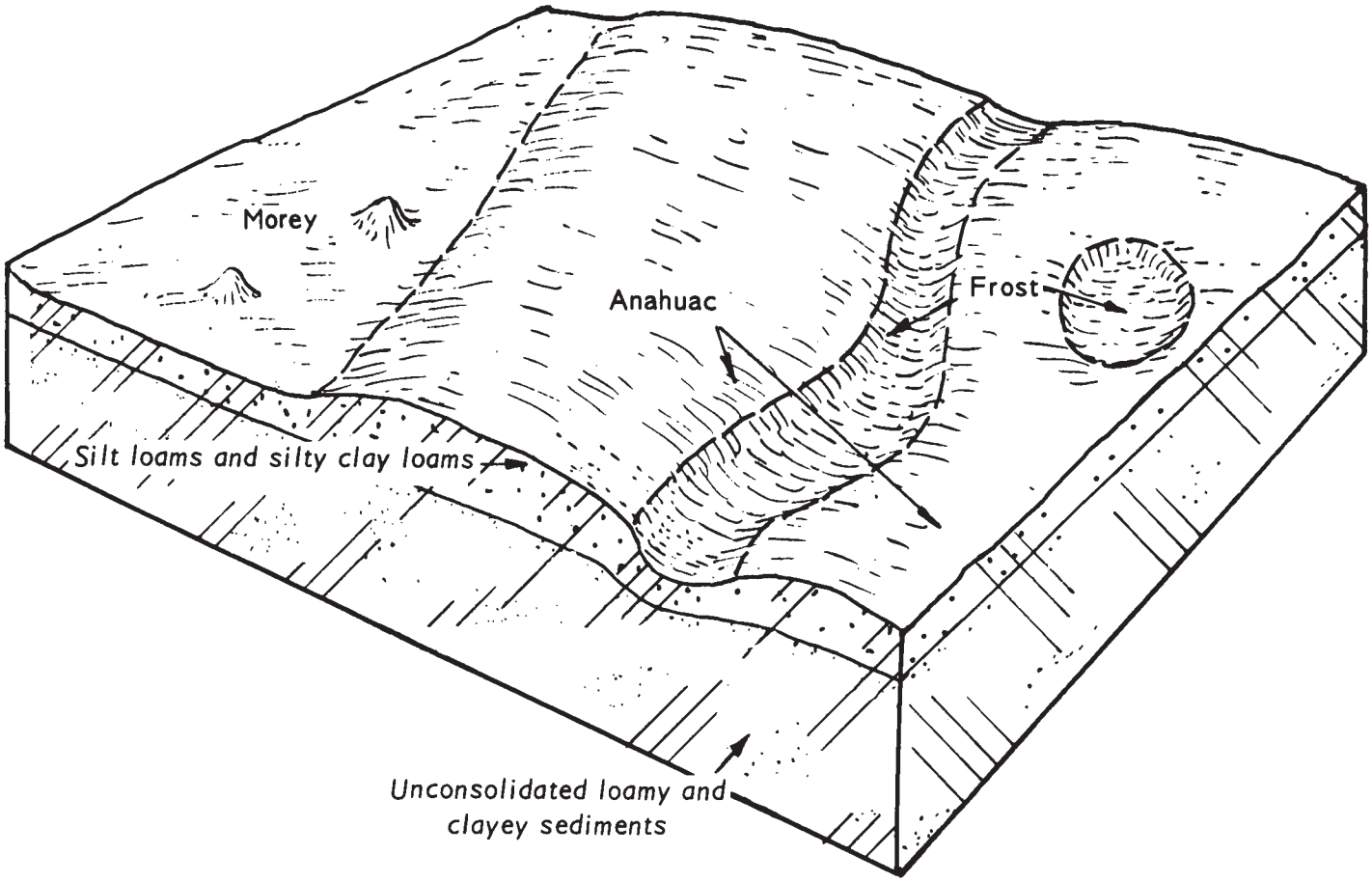

***Figure 5.*—Pattern of soils and underlying material in Anahuac-Morey-Frost association.**

dark grayish-brown clay about 4 inches thick. The next layer is 40 inches of clay that is mottled in shades of gray, yellow, and brown. The underlying material is mottled, gray clay that extends to a depth of 60 inches.

Acadia soils have a surface layer of silt loam about 9 inches thick that is dark gray in the upper part and grayish brown in the lower part. The next layer is 5 inches of mottled, brown silty clay loam. Below this is mottled clay that extends to a depth of 54 inches. It is grayish brown in the upper part and gray in the lower part.

Calhoun soils have a surface layer of mottled, gray silt loam about 12 inches thick. The next layer, about 30 inches thick, is gray silt loam in the upper 4 inches and dark-gray clay loam in the lower 26 inches. Below this is mottled, gray clay that reaches to a depth of 60 inches.

Minor soils in this association are the nearly level Beaumont soils and the McKamie soils, which are on slightly elevated ridges.

The soils in this association are suited to crops, range, pasture, wildlife habitat, trees, and recreational uses. They are used mainly for trees. Some areas are used for crops and pasture. Many businesses and homesites have been developed in the area since the completion of Interstate Highway 10 in 1959.

5. Harris-Kaufman association

Neutral and alkaline, saline and nonsaline, frequently flooded, clayey soils

This association is at the mouth of the Trinity River and is frequently flooded by freshwater from the river and by saltwater, during exceptionally high tides and during Gulf storms. Many natural drainageways and lakes are in this association. Harris soils are in depressional areas where water stands for most of the year. Kaufman soils are in slightly elevated areas that are flooded more frequently by freshwater than by saltwater.

This association makes up about 4 percent of the county. Harris soils make up about 67 percent of the association, Kaufman soils 20 percent, and minor soils 13 percent.

Harris soils have a surface layer of very dark gray clay about 19 inches thick that is mottled in the lower part. The next layer is mottled, dark-gray clay 25 inches thick. The underlying material is mottled, gray silty clay that extends to a depth of 60 inches.

Kaufman soils have a surface layer about 14 inches thick that is mottled, very dark gray clay in the upper 4 inches and black clay in the lower 10 inches. The next layer is mottled, very dark gray clay 10 inches thick.

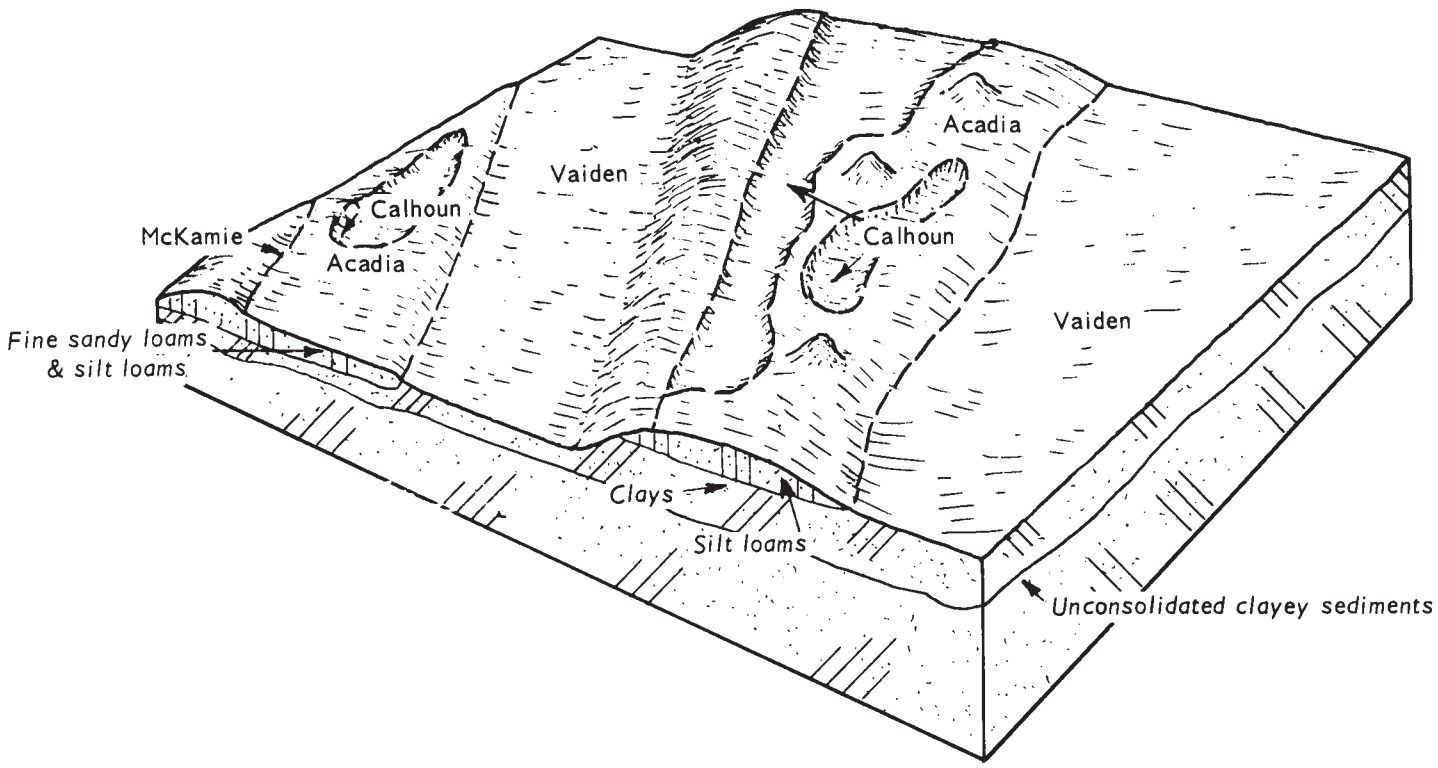

***Figure 6.*—Pattern of soils and underlying material in Vaiden-Acadia-Calhoun association.**

Below this is about 26 inches of mottled, black clay. The underlying material is mottled, very dark gray clay that reaches to a depth of 64 inches.

Minor soils in this association are the Clodine, McKamie, Vaiden, and Veston soils.

The soils in this association are suited to range, wildlife habitat, or recreational uses. Most areas are in large ranches and are used for range.

6. Stowell-Clodine association

Acid and alkaline, sandy and loamy soils

This association is slightly above sea level and has few natural drainageways. The Stowell soils are on sandy ridges about 2 to 10 feet above sea level. Clodine soils are in depressions 1 to 3 feet above sea level.

This association makes up about 4 percent of the county (fig. 7). Stowell soils make up about 58 percent of the association, Clodine soils 32 percent, and minor soils 10 percent.

Stowell soils have a surface layer of very dark gray loamy fine sand about 15 inches thick. The next layer is loamy fine sand 27 inches thick. It is dark grayish brown in the upper 9 inches, grayish brown in the next 8 inches, and light brownish gray and mottled in the lower 10 inches. The next layer is about 5 inches of mottled, yellowish-brown fine sandy loam over mottled, gray sandy clay loam that extends to a depth of 78 inches.

Clodine soils have a surface layer of very dark gray sandy clay loam about 5 inches thick. The next layer is mottled, dark-gray and gray sandy clay loam 46 inches thick. Below this, to a depth of 72 inches, is light olive-gray sandy clay loam.

Minor soils in this association are the Harris and Veston soils in some low areas. Harris soils are in level areas, and Veston soils are on low ridges. Sandy soils designated as Psamments occur as mounds.

The soils in this association are suited to range, pasture, wildlife habitat, and recreational uses. Most areas are in large ranches and are used for range.

Descriptions of the Soils

This section describes the soil series and mapping units in Chambers County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soils series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in this series is repre-

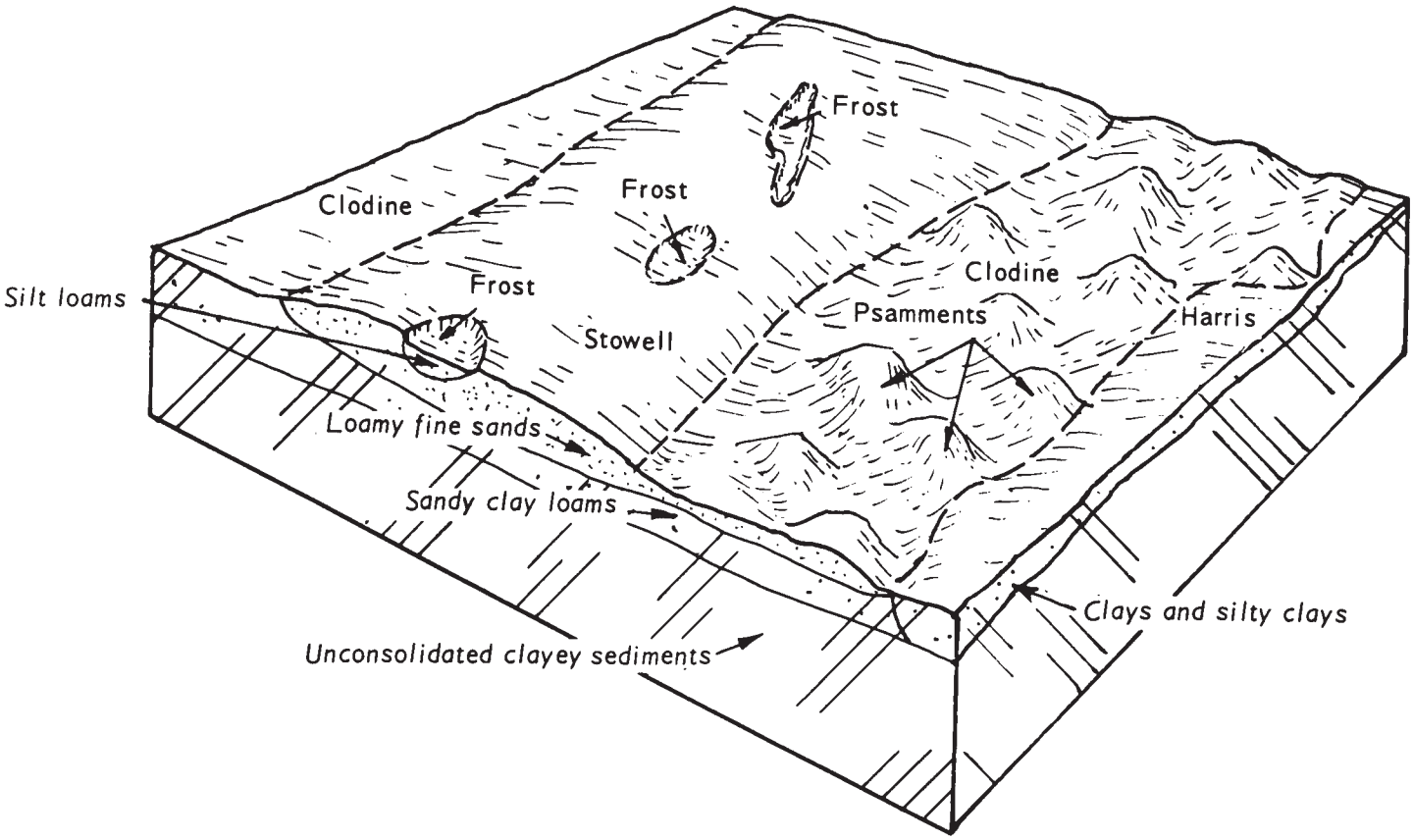

Figure 7.—**Pattern of soils and underlying material in Stowell-Clodine association.**

sentative of mapping units in that series. If the profile of a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, unless they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Psamments, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, the pasture and hay group, the range site, the woodland suitability group, and the woodland grazing group to which the mapping unit has been assigned. The page for the description of each of these groupings can be learned by referring to the "Guide to Mapping Units" at the back of this publication.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*9*).[1]

[1] Italic numbers in parentheses refer to Literature Cited, page 51.

Acadia Series

The Acadia series consists of deep, nearly level, acid, loamy soils in broad areas. These soils have slightly convex slopes. They formed in thick beds of acid clayey deposits under pine and hardwood trees.

In a representative profile the surface layer is mottled silt loam about 9 inches thick. It is dark gray in the upper part and grayish brown in the lower part. The next layer is about 5 inches of mottled, brown silty clay loam. Below this is mottled clay that extends to a depth of 54 inches. It is grayish brown in the upper part and gray in the lower part.

Acadia soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and internal drainage is very slow.

Representative profile of Acadia silt loam, 6 miles north of Anahuac on Farm Road 563, then west 0.2 mile on a county road, then 300 feet north on a second county road and 200 feet east of pavement:

A1—0 to 6 inches, dark-gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; few, fine, faint mottles of yellowish brown; moderate, medium, granular structure; very hard, firm, slightly sticky and plastic; common fine roots; medium acid; clear, wavy boundary.

A2—6 to 9 inches, grayish-brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; few, fine and medium, faint mottles of yellowish brown (10YR 5/4); weak, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; medium acid; abrupt, wavy boundary.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Acadia silt loam	3,650	0.6
Anahuac silt loam	17,245	3.1
Beaumont clay	111,662	20.0
Calhoun silt loam, sandy variant	2,901	.5
Clodine sandy clay loam	3,448	.6
Frost silt loam	3,585	.6
Frost–Anahuac complex, undulating	7,735	1.4
Frost–Morey complex, levelled	6,828	1.2
Harris clay	57,456	10.3
Ijam soils	1,900	.3
Kaufman clay, frequently flooded	2,682	.5
Lake Charles clay, 0 to 1 percent slopes	47,001	8.4
Lake Charles clay, 1 to 5 percent slopes	1,496	.3
McKamie fine sandy loam, wet variant, 1 to 5 percent slopes	1,097	.2
Morey silt loam, levelled	78,082	13.9
Psamments–Clodine complex, undulating	1,616	.3
Stowell loamy fine sand	5,716	1.0
Stowell–Clodine complex, undulating	5,189	.9
Vaiden clay, 0 to 1 percent slopes	15,072	2.7
Vaiden clay, 1 to 5 percent slopes	2,782	.5
Veston soils	4,374	.8
Water area	178,483	31.9
Total	560,000	100.0

B1—9 to 14 inches, brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; common, fine and medium, faint mottles of brownish yellow (10YR 6/6) and few, fine, distinct mottles of strong brown; weak, medium, angular blocky structure; hard, firm, sticky and plastic; few fine roots and pores; few clay films; few ped surfaces coated with white silt; very strongly acid; clear, wavy boundary.

B21tg—14 to 26 inches, grayish-brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common, fine and medium, distinct mottles of yellowish brown (10YR 5/4) and few, fine, prominent mottles of yellowish red and red; moderate, fine, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; common clay films; very strongly acid; clear, wavy boundary.

B22tg—26 to 54 inches, gray (10YR 5/1) clay, gray (10YR 6/1) dry; common, medium, distinct mottles of yellowish brown (10YR 5/6) and common, fine, distinct mottles of strong brown; moderate, fine and medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots on outside of peds; few clay films; few soft ferromanganese concretions; strongly acid.

The A horizon ranges from 7 to 15 inches in thickness. It is strongly acid or medium acid. The A1 horizon is dark gray, dark grayish brown, brown, gray, grayish brown, or yellowish brown. The A2 horizon is grayish brown, light brownish gray, brown, pale brown, very pale brown, yellowish brown, or light yellowish brown.

The B horizon is very strongly acid or strongly acid. The Bt horizon is gray, light gray, grayish brown, or light brownish gray, and it has few to many red mottles.

Acadia silt loam (Ac).—This soil is in areas 5 to 400 acres in size. Where the soil has not been burned over, the surface is covered by a layer of leaves and twigs 2 to 4 inches thick.

Included with this soil in mapping are a few, low, circular mounds of sandy loam. These mounds are 15 to 50 feet in diameter and rise 1 to 2 feet above normal ground level. A thin transitional layer of clay loam is common between the sandy loam surface layer and the clayey lower layer of the mounds. The mounds make up less than 10 percent of the mapped acreage. Also included are small areas of Calhoun silt loam, sandy variant, and Vaiden clay. These soils make up less than 2 percent of the mapped area.

This Acadia soil is used mainly for trees. Some small open areas are used as pasture and for home gardens. Capability unit IIIw–3; pasture and hay group 8A; woodland suitability group 2w8; Flatwoods woodland grazing group.

Anahuac Series

The Anahuac series consists of deep, nearly level, loamy soils. These acid soils formed in thick deposits of loamy material under tall prairie bunchgrasses. Slopes are less than 1 percent and are slightly convex.

In a representative profile the surface layer is silt loam about 18 inches thick. It is very dark gray in the upper part and very dark grayish brown in the lower part. The next 10 inches is mottled, brown silt loam. The next layer, about 34 inches thick, is mottled silty clay. It is dark gray in the upper part and grayish brown in the lower part. Below this is mottled sandy clay loam that extends to a depth of 74 inches.

Anahuac soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and internal drainage is very slow.

Representative profile of Anahuac silt loam, 1 mile west of Winnie on Interstate Highway 10, then 1.6 miles north on Farm Road 1406, then 300 feet east on a county road and 100 feet north of the road:

A1—0 to 10 inches, very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; medium acid; gradual, wavy boundary.

A12—10 to 18 inches, very dark grayish-brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; medium acid; gradual, wavy boundary.

A2—18 to 28 inches, brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; few, fine, faint, brownish-yellow mottles; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; thin coating on sand grains; strongly acid; abrupt, wavy boundary.

B21tg—28 to 42 inches, dark-gray (10YR 4/1) silty clay, gray (10YR 5/1) dry; common, fine and medium, prominent mottles of dark red (2.5YR 3/6) and few, fine, distinct mottles of yellowish brown; moderate, medium, angular blocky structure; very hard, very firm, sticky and plastic; few fine roots on outside of peds; dark-gray clay films on surface of peds; strongly acid; clear, wavy boundary.

B22tg—42 to 62 inches, grayish-brown (10YR 5/2) silty clay, light brownish gray (10YR 6/2) dry; common, fine, distinct mottles of brownish yellow and few to common, fine, prominent mottles of yellowish red; moderate, coarse, angular blocky structure; very hard, very firm, sticky and plastic; few fine roots; clay films on surface of peds; strongly acid; clear, wavy boundary.

B3t—62 to 74 inches, mottled light brownish-gray (10YR 6/2) and yellowish-red (5YR 5/6) sandy clay loam; common, fine distinct mottles of yellowish brown; weak, medium, angular blocky structure; friable, slightly sticky and plastic; few fine roots; few clay films on surface of peds; few, fine, weakly cemented, brown and black concretions; medium acid.

The A1 horizon ranges from 10 to 20 inches in thickness.

It is very dark gray or very dark grayish brown and is strongly acid to slightly acid. The A2 horizon ranges from 4 to 14 inches in thickness. It is brown or pale brown and is strongly acid or medium acid. The boundary between the A2 horizon and the B2t horizon is clear or abrupt.

The Bt horizon ranges from strongly acid to neutral. The B2t horizon is dark gray or grayish brown and has few to many red, yellow, and brown mottles. The B3t horizon is gray, light olive gray, pale olive, olive gray, light brownish gray, or pale brown. It is mottled with olive, yellow, red, and brown.

Anahuac silt loam (An).—This soil is in long, narrow, slightly elevated areas 5 to 200 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are circular, depressional areas of Frost soils that are less than 2 acres in size and areas of Frost soils, less than 200 feet wide and 300 to 800 feet long, in long, narrow, old, winding streambeds. Also included is approximately 3 percent of this Anahuac soil that has been smoothed for farming. Land smoothing removes part of the dark, thick, surface horizon and, in places, exposes the lower horizons. All included areas make up less than 15 percent of the mapped acreage.

This Anahuac soil is used mainly for crops. Some areas are used as native range. Capability unit IIIw–3; Sandy Prairie range site; pasture and hay group 8A.

Beaumont Series

The Beaumont series consists of deep, nearly level, clayey soils on broad flats. These acid soils formed in alkaline, but noncalcareous, clayey sediment under a cover of grass. Slopes are less than 0.4 percent. Shallow, enclosed microdepressions known as gilgai, or hogwallows, alternate with slightly higher microknolls.

In a representative profile the surface layer is dark-gray clay 22 inches thick that has yellowish-brown mottles. The next layer, about 26 inches thick, is dark-gray clay that has brownish-yellow mottles. The underlying material is mottled, gray clay that extends to a depth of 72 inches.

Beaumont soils are poorly drained. Permeability is very slow, and available water capacity is high. Runoff and internal drainage are very slow.

Representative profile of Beaumont clay, 3 miles west of Winnie on Interstate Highway 10, then 0.9 mile south on a county road to the end of the road and 200 feet southwest, in a microdepression:

Ap—0 to 8 inches, dark-gray (10YR 4/1) clay, gray (10YR 5/1) dry; common, fine and medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, angular blocky structure; very hard, very firm, sticky and plastic; many fine roots; dark reddish-brown coating on many root channels and surface of peds; few, fine, cemented concretions of iron oxide; strongly acid; abrupt, smooth boundary.

A1—8 to 22 inches, dark-gray (10YR 4/1) clay, gray (10YR 5/1) dry; common, fine and medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; dark-brown coating on many root channels and surface of peds; shiny pressure faces on many peds; few, fine, cemented concretions of iron oxide; strongly acid; gradual, wavy boundary.

ACg—22 to 48 inches, dark-gray (10YR 4/1) clay, gray (10YR 5/1) dry; many, faint, fine and medium, brownish-yellow (10YR 6/6) mottles and few, distinct, strong-brown mottles; common, coarse, intersecting slickensides parting to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; shiny pressure faces; few, fine, cemented concretions of iron oxide; strongly acid; diffuse, wavy boundary.

C1g—48 to 52 inches, coarsely mottled, gray (2.5Y 5/1) and yellowish-brown (10YR 5/8) clay; slickensides occur diagonally every 3 or 4 inches, are intersected by more horizontal shear planes at 2-inch intervals, and change to irregular or wedge-shaped structural units that are medium blocky; sticky and very plastic; dark-gray material, apparently from above, fills krotovinas that are about 1½ inches in diameter and 10 inches apart; medium acid; gradual, wavy boundary.

C2g—52 to 72 inches, gray (10YR 5/1) clay, gray (10YR 6/1) dry; common, faint, fine and medium mottles of brownish yellow (10YR 6/6); slickensides as above parting to coarse, blocky structural units; very hard, sticky and very plastic; mildly alkaline.

The A horizon ranges from 10 inches in thickness on the microhighs to 25 inches in the microdepressions. It is gray, dark gray, or very dark gray. Mottles range from 5 to 20 percent of the mass.

The ACg horizon is dark gray, gray, or light gray. Mottles range from 5 to 40 percent of the total mass. They are mostly yellowish brown but are also brownish yellow, strong brown, or light gray. At a depth of 10 to 40 inches, the soil is 50 to 60 percent clay.

The Cg horizon is light gray or gray and has few to many yellowish-brown or brownish-yellow mottles. It ranges from strongly acid to moderately alkaline.

Beaumont clay (Be).—This soil is in areas 10 to 1,500 acres in size. Where this soil is in native range or in improved pasture, the upper 4 inches has granular structure. Where it is used for rice, the surface layer is massive or has coarse platy structure.

Included with this soil in mapping are a few, small, slightly elevated areas of Morey soils that have low, sandy, circular mounds in places. These areas make up less than 2 percent of the mapped acreage. In areas where this Beaumont soil is adjacent to Harris soils, the surface of the Beaumont soil is slightly saline in places.

This soil is used mostly for crops. Some areas are used as native range and improved pasture. In a few places, the soil supports a good growth of trees. Capability unit IIIw–1; Blackland range site; pasture and hay group 7A; woodland suitability group 2w8; Blackland woodland grazing group.

Calhoun Variant

The Calhoun variant consists of nearly level or depressional, loamy soils. These deep acid soils formed in thick beds of loamy and clayey material under trees. Slopes are less than 1 percent and are slightly convex.

In a representative profile the surface layer is gray, mottled silt loam about 12 inches thick. The next layer is about 30 inches thick. It is gray silt loam in the upper 4 inches and dark-gray clay loam in the lower 26 inches. Below this is mottled, gray clay that extends to a depth of 60 inches.

Calhoun soils are poorly drained. Permeability is slow, and available water capacity is high. Runoff and internal drainage are very slow.

Representative profile of Calhoun silt loam, sandy variant, 6 miles northeast of Anahuac on Texas Highway 61, then 0.2 mile east on Interstate Highway 10 and 200 feet south of the highway:

A1—0 to 4 inches, gray (10YR 5/1) silt loam, gray (10YR 6/1) dry; few, fine, faint mottles of white and brownish yellow; weak, fine, angular blocky structure; very hard, friable, slightly sticky and plastic; few fine roots and pores; medium acid; clear, smooth boundary.

A2g—4 to 12 inches, gray (10YR 6/1) silt loam, light gray (10YR 7/1) dry; few, fine, faint mottles of yellowish brown; weak, angular blocky structure; very hard, friable, slightly sticky and plastic; few fine roots and pores; strongly acid; clear, irregular boundary.

B21tg—12 to 16 inches, gray (10YR 5/1) silt loam, gray (10YR 6/1) dry; common, fine, faint mottles of light gray and few, fine, distinct mottles of yellowish brown; weak, medium, blocky and angular blocky structure; very hard, firm, sticky and plastic; few, fine, root channels stained strong brown; tongues ½ inch to 1 inch wide and pockets of light-gray (10YR 7/1) silt loam from above horizons extend through the horizon; few thin clay films on surface of peds; few, fine, hard concretions of ferromanganese; very strongly acid; clear, wavy boundary.

B22tg—16 to 30 inches, dark-gray (10YR 4/1) clay loam, gray (10YR 5/1) dry; few, fine, distinct mottles of strong brown; moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots on outside of peds; few fine pores; pockets, 1 inch to 2 inches in diameter and 3 to 4 inches long, of light-gray (10YR 7/1) silty material; coating of white silt or very fine sand in many cracks and on ped faces; clay films on surface of some peds; strongly acid; gradual, clear boundary.

B23tg—30 to 42 inches, dark-gray (10YR 4/1) clay loam, gray (10YR 5/1) dry; common, fine and medium, distinct mottles of yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6); weak, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; white material in some cracks; few clay films; strongly acid; gradual, clear boundary.

B3tg—42 to 60 inches, gray (10YR 5/1) clay, gray (10YR 6/1) dry; few, fine, distinct, yellowish-brown mottles; weak, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; light-gray silty material in a few cracks; strongly acid.

The A horizon ranges from 7 to 20 inches in thickness. It is gray or grayish brown and has few to many mottles of white, yellowish brown, strong brown, or brownish yellow and a few yellowish-red mottles.

The B horizon is very strongly acid or strongly acid. The Bt horizon in the upper 20 inches is silt loam, clay loam, or silty clay loam and is 10 to 25 percent sand. The B2t horizon is gray, dark gray, or grayish brown and has few to many mottles of light gray, strong brown, yellowish brown, or brownish yellow.

Calhoun silt loam, sandy variant (Ca).—This soil is in areas 10 to 200 acres in size. In places the surface is covered by 1 to 2 inches of partly decomposed leaves and twigs.

Included with this soil in mapping are some long, narrow areas, 5 to 10 acres in size, of Vaiden clay that are near natural drainageways. Some sandy mounds 25 to 50 feet wide and 2 to 4 feet high are also mapped with this soil. Included areas make up less than 10 percent of the mapped acreage.

This Calhoun soil receives runoff from other soils and is saturated for long periods each year. Most areas are in trees, but a few areas have been cleared and used for crops or improved pasture. Capability unit IIIw–2; pasture and hay group 8E; woodland suitability group 2w9; Flatwoods woodland grazing group.

Clodine Series

The Clodine series consists of deep loamy soils that are nearly level or depressional. These alkaline and saline soils formed in thick beds of silty and clayey material under water-loving and salt-tolerant grasses and sedges. Slopes are less than 1 percent and are slightly convex.

In a representative profile the surface layer is very dark gray sandy clay loam about 5 inches thick. The next layer is mottled sandy clay loam about 46 inches thick. It is dark gray in the upper part and gray in the lower part. Below this is mottled, light olive-gray sandy clay loam that extends to a depth of 72 inches.

Clodine soils are poorly drained. Permeability is slow. Available water capacity is low or moderate, depending on salinity. Runoff is very slow, and internal drainage is slow.

Representative profile of Clodine sandy clay loam, 8 miles northeast of Smith Point on Farm Road 562, then 0.6 mile north on a private road and 600 feet west of the road:

A1—0 to 5 inches, very dark gray (10YR 3/1) sandy clay loam, dark gray (10YR 4/1) dry; weak, fine, granular structure; very hard, friable, slightly sticky and plastic; common, fine, fibrous roots; few fine pores; few wormcasts; saline; moderately alkaline; clear, smooth boundary.

B21tg—5 to 16 inches, dark-gray (10YR 4/1) sandy clay loam, gray (10YR 5/1) dry; few, fine, faint, yellowish-brown mottles; moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; few, fine, fibrous roots; thin clay films on peds; few fine gypsum crystals; fine white silt on outside of some peds; saline; moderately alkaline; clear, wavy boundary.

B22tg—16 to 36 inches, gray (5Y 5/1) sandy clay loam, gray (5Y 6/1) dry; few, fine, faint, olive mottles; moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; thin clay films on peds; few fine gypsum crystals; saline; moderately alkaline; gradual, wavy boundary.

B23tg—36 to 51 inches, gray (5Y 6/1) sandy clay loam, light gray (5Y 7/1) dry; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; moderate, medium, angular blocky structure, very hard, friable; few dark-gray streaks in old krotovinas and on outside of peds; common gypsum crystals; saline; moderately alkaline; gradual, wavy boundary.

B3tg—51 to 72 inches, light olive-gray (5Y 6/2) sandy clay loam, light gray (5Y 7/2) dry; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; massive; very hard, friable; few white sand grains and small cracks; few, dark, firm concretions; common gypsum crystals; saline; moderately alkaline.

The A horizon ranges from 5 to 10 inches in thickness. It is gray, dark-gray, or very dark gray loam, sandy clay loam, or fine sandy loam. It ranges from neutral to moderately alkaline. The boundary between the A horizon and the B2t horizon is clear to gradual.

The Bt horizon is mottled in shades of yellow, brown, olive, and gray. The B2t horizon is dark gray or gray loam, sandy clay loam, or clay loam. In the upper part it is 18 to 35 percent clay, 20 to 45 percent silt and very fine sand, and more than 15 percent sand that is coarser than very fine sand.

Clodine soils in Chambers County are outside the range of the Clodine series in that they have a surface layer of sandy clay loam and are mottled with olive and gray. These differences, however, do not alter their use or management.

Clodine sandy clay loam (Cd).—This soil is in areas 10 to 30 acres in size at elevations ranging from sea level to 5 feet above sea level. It has the profile described

as representative of the series. Surface crusts are common in areas where vegetation is sparse. Salinity is variable and fluctuates. In cool seasons, or when rainfall is high, surface salinity is low. In warm seasons, when rainfall is low, or in periods following Gulf storms, salinity is high.

Included with this soil in mapping are some depressional areas of Harris clay and some sandy, circular mounds of Stowell loamy fine sand. Also included are areas of Clodine soil that are not saline because they have been protected from saltwater intrusion or because freshwater has been applied to leach salt from the surface. Some of these areas are as large as 20 acres in size. Included areas make up less than 15 percent of the mapped acreage.

This Clodine soil is too salty, too wet, and too frequently damaged by storms to be cultivated or used for timber. It is suited to range, pasture, wildlife habitat, and recreational uses. Some areas can be used for improved pasture. Capability unit VIs–1; Salty Prairie range site; pasture and hay group 7G.

Frost Series

The Frost series consists of deep, acid, loamy soils that are nearly level or depressional. These soils formed in thick beds of loamy and clayey material under prairie grasses. Slopes are less than 1 percent and are convex.

In a representative profile the surface layer is mottled silt loam about 12 inches thick. It is dark gray in the upper part and gray in the lower part. The next layer, to a depth of 54 inches, is mottled, gray silty clay loam.

Frost soils are poorly drained. Permeability is slow, and available water capacity is high. Runoff is very slow, and internal drainage is slow.

Representative profile of Frost silt loam, 5.8 miles south of Anahuac on Farm Road 563, then 1.2 miles east on Double Bayou Road (a county road) and 300 feet north of the road:

A1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; few, fine, faint mottles of yellowish brown; weak, fine, angular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; common streaks of light-gray fine sand; white, thin, silty crust on surface when dry; medium acid; clear, smooth boundary.

A2g—4 to 12 inches, gray (10YR 5/1) silt loam, gray (10YR 6/1) dry; few, fine, distinct mottles of yellowish brown; weak, fine, angular blocky structure; very hard, slightly sticky and plastic; few fine roots; root cavities stained strong brown; few fine pores; few fine concretions of ferromanganese; common streaks and pockets of light-gray fine sand; medium acid; clear to gradual, wavy boundary.

B21tg & A2g—12 to 20 inches, gray (10YR 5/1) silty clay loam, gray (10YR 6/1) dry; few, fine, distinct mottles of yellowish brown; moderate, fine, angular blocky structure; very hard, firm, slightly sticky and plastic; common streaks and splotches (weakly developed tongues) of light-gray fine sand or silt loam; common crayfish krotovinas, 6 inches apart, filled with silt; few clay films on ped surfaces; few ferromanganese concretions; slightly acid; gradual, wavy boundary.

B22tg—20 to 54 inches, gray (10YR 5/1) silty clay loam, gray (10YR 6/1) dry; few, fine, distinct mottles of yellowish brown; weak, medium, blocky structure; very hard, firm, sticky and plastic; common sand pockets and crayfish krotovinas; few ferromanganese concretions; slightly acid.

The A horizon ranges from 8 to 15 inches in thickness and is dark gray, gray, or light gray in color. The boundary between the A horizon and the Bt horizon is clear to gradual and smooth to wavy.

The Bt horizon is gray or dark gray and has few to many mottles of yellowish brown and light gray. It has crayfish krotovinas that range from 1 to 2 inches in diameter and are 6 to 18 inches apart. The B2tg horizon ranges from medium acid to moderately alkaline.

Frost silt loam (Fo).—This soil is in areas 5 to 50 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Anahuac and Morey soils less than 3 acres in size on large mounds and low ridges. Small areas of Beaumont and Lake Charles soils are also included. Included areas make up less than 5 percent of the mapped acreage.

This Frost soil is used for crops, improved pasture, and native range. Small areas are in trees. Where this soil is cultivated, surface crusts and plowpans are common. Runoff from surrounding soils accumulates on this soil. Capability unit IIIw–2; Lowland range site; pasture and hay group 8E; woodland suitability group 2w9; Flatwoods woodland grazing group.

Frost-Anahuac complex, undulating (FrB).—This mapping unit is made up of undulating soils in areas 25 to 150 acres in size. It is 50 to 70 percent Frost silt loam, 25 to 45 percent Anahuac silt loam, and 5 to 25 percent other soils.

Frost silt loam is in old shallow drainageways that are 50 to 100 feet wide and 100 to 1,000 feet long. In most places the Frost soil is surrounded by the slightly elevated Anahuac soil and other soils, and water stands on the surface for long periods after rains. The Anahuac soil is on circular or elongated mounds or ridges that are 50 to 200 feet wide and 200 to 600 feet long. Morey silt loam is in small narrow areas near the outer edges of areas of this mapping unit.

The Frost soil has a surface layer of mottled silt loam 10 inches thick. It is gray in the upper part and light gray in the lower part. The next layer is mottled, gray silty clay loam that reaches to a depth of 54 inches.

The Anahuac soil has a surface layer of very dark grayish-brown silt loam about 18 inches thick. The next 10 inches is brown silt loam. Below this is dark-gray and grayish-brown silty clay about 34 inches thick. It is underlain by mottled sandy clay loam to a depth of 74 inches.

Included with these soils in mapping are areas of soils where the surface has been smoothed and the lower layers are exposed.

The soils in this mapping unit are used for crops, improved pasture, and range. A few areas are in trees. Capability unit IIIw–2; Frost part in Lowland range site, and Anahuac part in Sandy Prairie range site; pasture and hay group 8E.

Frost-Morey complex, levelled (Fs).—This mapping unit is in areas 20 to 150 acres in size. It is 45 to 65 percent Frost silt loam, 35 to 55 percent Morey silt loam, and 5 to 10 percent other soils.

In its natural condition, the Frost soil in this mapping unit is in depressional areas. The Morey soil is in nearly level areas that are slightly higher than areas of the Frost soil. Most areas of this mapping unit, however, have been leveled for rice culture. Water stands on the surface of these soils for long periods after rains.

The Frost soil has a surface layer of silt loam 9 inches thick. It is mottled gray in the upper part and mottled light gray in the lower part. The next layer is mottled, gray silty clay loam that extends to a depth of 54 inches.

The Morey soil has a surface layer of very dark gray silt loam 9 inches thick. The next layer is about 18 inches of mottled, dark-gray silty clay loam. Below this is mottled, gray and grayish-brown silty clay loam that extends to a depth of about 60 inches.

Included with these soils in mapping are areas of Beaumont and Lake Charles soils in small depressional areas. Also included are a few, small, circular mounds and saline areas.

The soils in this mapping unit are used for crops, improved pasture, and range. Trees are grown in some small areas. Capability unit IIIw–2; Frost part in Lowland range site, and Morey part in Loamy Prairie range site; pasture and hay group 8E; woodland suitability group 2w9; Fatwoods woodland grazing group.

Harris Series

The Harris series consists of deep, wet, saline, clayey soils that are nearly level or depressional. These soils formed in saline, clayey, coastal sediment under water-loving and salt-tolerant grasses and sedges. They are at elevations ranging from sea level to 4 feet above sea level. They are saturated for periods of 4 to 8 months and are never below field capacity.

In a representative profile the surface layer, about 19 inches thick, is very dark gray clay that is mottled in the lower part. The next layer is mottled, dark-gray clay about 25 inches thick. The underlying material is mottled, gray silty clay that extends to a depth of 60 inches.

Harris soils are very poorly drained. Gulf storms and very high tides flood most areas. A permanent water table fluctuates between the surface and a depth of about 50 inches. Permeability is very slow. Available water capacity is low or moderate, depending on salinity. Runoff and internal drainage are very slow.

Representative profile of Harris clay, 2 miles east of Anahuac on Texas Highway 61, then 8 miles south on Farm Road 562, then 4.2 miles east on Farm Road 1985, then 11.3 miles southeast on a shell and dirt road. This site is 600 feet west of Oyster Bayou and 0.3 mile northwest of spoil bank of the Bayou:

A11g—0 to 5 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate, medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; many medium grass roots; many old root channels stained strong brown; saline; neutral; gradual, smooth boundary.

A12g—5 to 12 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate, medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; few medium grass roots; many old root channels stained strong brown to red; saline; mildly alkaline; gradual, smooth boundary.

A13g—12 to 19 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few, fine, distinct, yellowish-brown mottles; moderate, medium, blocky structure; very hard, very firm, very sticky and very plastic; few fine grass roots; root channels stained yellowish brown; few, shiny, pressure faces on surface of peds; saline; mildly alkaline; clear, wavy boundary.

B21g—19 to 30 inches, dark-gray (2.5Y 4/1) clay, gray (2.5Y 5/1) dry; few, fine, distinct, yellowish-brown mottles and few, fine, faint, gray mottles; moderate, coarse, prismatic structure parting to moderate, medium and fine, blocky; very hard, very firm, very sticky and very plastic; few fine grass roots; coating of light-gray silty material on few prisms; saline; mildly alkaline; clear, wavy boundary.

B22g—30 to 44 inches, dark-gray (2.5Y 4/1) clay, gray (2.5Y 5/1) dry; common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, faint, gray and light-gray mottles; moderate, coarse, prismatic structure parting to weak, medium, blocky; very hard, very firm, very plastic; few fine grass roots; coating of light-gray silty material on few prisms; common, fine, dark concretions; saline; mildly alkaline; diffuse, smooth boundary.

Cg—44 to 60 inches, gray (5Y 5/1) silty clay, gray (5Y 6/1) dry; common, fine and medium, distinct, yellowish-brown (10YR 5/8) mottles and few, fine, faint, light-gray mottles; massive; very hard, firm, sticky and plastic; very few fine roots; few, fine, dark concretions; saline; mildly alkaline.

The A horizon ranges from 10 to 20 inches in thickness. It is very dark gray or black and ranges from slightly acid to strongly alkaline.

The B2g horizon is mottled in shades of yellow, brown, or gray.

The Cg horizon is gray or light gray and ranges from mildly alkaline to strongly alkaline.

Harris clay (Ha).—This soil is in areas 10 to 1,500 acres in size. In places it has been protected from saltwater by levees, and freshwater has been added. In these areas this soil is nonsaline to a depth of 18 inches and is slightly acid or neutral.

Included with this soil in mapping are narrow, winding, depressional areas of soils that have a layer of partially decomposed organic matter as much as 30 inches thick. Water is above the surface of these soils most of the year. Also included are areas of soils that are underlain by fine sand and bodies of water 5 to 10 acres in size. Included areas make up less than 5 percent of the mapped acreage.

This Harris soil is not suitable for cultivation without extensive reclamation, such as levees for protection and pumpoff systems for drainage. It is better suited to range and wildlife habitat than to most other uses. Capability unit VIIw–1; Salt Marsh range site.

Ijam Series

The Ijam series consists of deep, nearly level, clayey soils that are alkaline and saline. These soils formed in alkaline, saline, clayey, marine and alluvial sediment that was dredged or pumped from the floor of rivers, bays, and canals or was removed from the land surface during construction of canals or waterways. They are in areas where the elevation ranges from sea level to 8 feet above sea level. Slopes are plane to concave.

In a representative profile the surface is dark-gray clay about 8 inches thick. The next layer is mottled, dark-gray and gray clay that extends to a depth of 62 inches.

Ijam soils are very poorly drained or ponded. Permeability is very slow, and available water capacity is moderate. Runoff and internal drainage are very slow.

Representative profile of Ijam clay, in an area of

Ijam soils, about 50 feet west of dirt road, from a point 0.5 mile south and 0.2 mile west of Fort Anahuac Park:

A1—0 to 8 inches, dark-gray (10YR 4/1) clay; massive; very firm, very sticky and very plastic; many roots; calcareous; moderately alkaline; diffuse, smooth boundary.

Cg—8 to 62 inches, mottled dark-gray (5Y 4/1) and gray (5Y 6/1) clay; massive; very firm, very sticky and plastic; few roots, mostly in the upper part; few to common streaks and splotches of various shades of gray, yellowish brown, and strong brown; few thin, discontinuous strata or lenses of sandy clay loam and fine sandy loam; discontinuous bedding planes; few shells and shell fragments; saline; moderately alkaline.

The A horizon ranges from 2 to 10 inches in thickness and is silt loam, clay loam, or clay. It is dark gray, light gray, or dark grayish brown and is neutral to strongly alkaline. In a few places a horizon of fine sand, 2 to 4 inches thick, has been deposited on the surface.

The Cg horizon is light olive gray, dark gray, gray, light gray, or dark grayish brown and is moderately alkaline or strongly alkaline.

Ijam soils (Im).—These soils are in areas 10 acres to several hundred acres in size.

Included with these soils in mapping are some excavated areas of soils that differ from Ijam soils in texture, color, stratification, and depth of horizons. Some of these soils have stratified coarse sand and oystershell layers, and some have yellowish-brown lower layers. In some areas where mud and slush are pumped on existing surfaces and allowed to spread at natural flow, the original dark surface layer becomes the subsoil. The thickness of horizons and the texture depend on the soil that is excavated and the depth of excavations. Some material comes from as deep as 30 feet below the surface, and some comes from as shallow as 4 feet. Included areas make up less than 20 percent of the mapped acreage.

These Ijam soils are not suitable for cultivation or for timber. Some high areas are used for livestock and wildlife habitat and are helpful in regulating water levels in marsh. Some areas are used for recreational facilities. Capability unit VIIw–2; Salty Prairie range site.

Kaufman Series

The Kaufman series consists of deep, nearly level, alkaline soils on flood plains. These clayey alluvial soils formed in recent, alkaline, clayey sediment under hardwood trees.

In a representative profile the surface layer is clay about 14 inches thick. It is very dark gray and mottled in the upper part and is black in the lower part. The next layer is very dark gray, mottled clay 10 inches thick. Below this to a depth of 50 inches, is black clay that is mottled in the lower part. The underlying material is mottled, very dark gray clay that extends to a depth of 64 inches.

Kaufman soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and internal drainage is very slow.

Representative profile of Kaufman clay, frequently flooded, 5.5 miles northwest of Anahuac on Farm Road 563, then 4.5 miles west on a county road and 900 feet south of the road. This site is at the east bank of the Trinity River, 0.3 mile south of Interstate Highway 10:

A11—0 to 4 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few, fine, faint, yellowish-brown mottles; moderate, fine, angular blocky structure; extremely hard, very firm, sticky and very plastic; common fine roots; mildly alkaline; clear, smooth boundary.

A12—4 to 14 inches, black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate, fine, angular and subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; shiny pressure faces; mildly alkaline; gradual, wavy boundary.

Bg—14 to 24 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few, fine, faint, brownish-yellow mottles; moderate, medium, angular and subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; coating of light-gray silty material on many ped faces; light-gray silty material in common cracks 1 inch in diameter; neutral; clear, wavy boundary.

A11bg—24 to 40 inches, black (2.5Y 2/0) clay, very dark gray (2.5Y 3/0) dry; moderate, medium, angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots on outside of peds; few strong-brown stains along root channels; shiny pressure faces; few cracks 1 inch in diameter and 2 feet apart, some filled with dark-gray clay; neutral; gradual, wavy boundary.

A12bg—40 to 50 inches, black (2.5Y 2/0) clay, very dark gray (2.5Y 3/0) dry; few, fine, distinct, light olive-brown mottles; moderate, medium, angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots on outside of peds; shiny pressure faces; neutral; gradual, wavy boundary.

Cg—50 to 64 inches, very dark gray (2.5Y 3/1) clay, dark gray (2.5Y 4/1) dry; common, fine and medium, distinct, light olive-brown (2.5Y 5/6) mottles; massive; very few roots; white silty material in few fine pockets; neutral.

The profile ranges from slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. It is 45 to 60 percent clay in the upper 40 inches, but in some places where overwash material has been added, it is only 40 percent clay. Mottles in shades of yellow, brown, and olive range from few to common throughout the profile.

The A horizon is black or very dark gray.

The Bg and C horizons are gray or very dark gray. The Bg horizon is not in some profiles, and in some profiles the Cg horizon has thin strata of coarser material.

Kaufman clay, frequently flooded (Ka).—This soil is flooded by freshwater at least once every 3 years and is flooded several times in most years. High tides and strong winds from the south increase the duration of the floods when rainfall is heavy in the Trinity River watershed. In some seasons of low rainfall, high tides and Gulf storms flood the soil with brackish water or saltwater, but this soil is flooded more often by freshwater than by brackish water. Areas are 100 to 1,500 acres in size.

Included with this soil in mapping are small areas of soils that are similar to Kaufman clay, but they have about 12 inches of sandy loam deposited on the surface. In a few places near the river channel, areas where recent deposits of loamy fine sand are on the surface are included in mapping. Also included are some depressional areas, less than 10 acres in size, where the surface layer is partly decomposed organic matter 12 to 14 inches thick. Included areas make up less than 15 percent of the mapped acreage.

This Kaufman soil is not suitable for cultivation without extensive reclamation, such as levees for protection

and pumpoff systems for drainage. It is suited to improved pasture, range, timber production, and wildlife habitat. Capability unit Vw–1; Bottomland range site; pasture and hay group 1A; woodland suitability group 1w6; Clayey Bottomland woodland grazing group.

Lake Charles Series

The Lake Charles series consists of deep, nearly level or gently sloping, clayey soils. These acid soils formed in alkaline and calcareous clay under grasses. Cracks form on the surface when this soil is dry.

In a representative profile the surface layer, about 36 inches thick, is black clay that is mottled in the upper part. The next layer is mottled, very dark gray clay that extends to a depth of 64 inches.

Lake Charles soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff and internal drainage are very slow.

Representative profile of Lake Charles clay, 0 to 1 percent slopes, 5.2 miles south of Mont Belvieu on Texas Highway 146, then 4.3 miles south on Farm Road 1405 and 200 feet east of the road, in a microdepression:

A11—0 to 16 inches, black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; few, fine, prominent, brownish-yellow mottles; weak, fine, blocky and angular blocky structure; very hard, very firm, very sticky and plastic; few, fine, fibrous roots; shiny pressure faces; few, fine, black concretions and few, medium, pitted concretions of calcium carbonate; neutral; clear, smooth boundary.

A12—16 to 36 inches, black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate, fine, blocky and subangular blocky structure in upper 12 inches; common, large, wedge-shaped peds in the lower part that have long axes tilted 10 to 60 degrees from the horizontal and are bordered by intersecting slickensides parting to moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and plastic; common shiny pressure faces; few fine concretions of ferromanganese and calcium carbonate; slightly acid; diffuse, wavy boundary.

AC1g—36 to 48 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few, fine and medium, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/8) mottles; common, large, wedge-shaped peds that have long axes tilted 10 to 60 degrees from the horizontal and are bordered by intersecting slickensides parting to moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; shiny pressure faces; few, fine, black concretions ⅛ inch in diameter and few calcium carbonate concretions up to ¼ inch in diameter; slightly acid; diffuse, wavy boundary.

AC2g—48 to 64 inches, very dark gray (2.5Y 3/1) clay, dark gray (2.5Y 4/1) dry; few, fine and medium, distinct, yellowish-brown (10YR 5/8) mottles; common, large, wedge-shaped peds that have long axes tilted 10 to 60 degrees from the horizontal, and are bordered by intersecting slickensides parting to moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; shiny pressure faces; few concretions of calcium carbonate up to ¼ inch in diameter; neutral.

The A horizon ranges from 12 to 36 inches in thickness on the microknolls and from 26 to 50 inches in thickness in the microdepressions. It is very dark gray or black, is 50 to 60 percent clay, and is slightly acid to mildly alkaline.

The AC horizon is very dark gray, dark gray, or gray and has few to many, brownish-yellow and yellowish-brown mottles. It is slightly acid to moderately alkaline.

The Lake Charles soils in Chambers County that are in mapping unit LaB are outside the range of the Lake Charles series. They have chroma greater than 1.5 at a depth of 36 inches. This difference, however, does not alter their use and management.

Lake Charles clay, 0 to 1 percent slopes (LaA).—This nearly level soil is in areas 10 to 1,500 acres in size. In most places it is not affected by floodwaters from Gulf storms. Slopes are less than 1 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping and near the outer edge of the mapped area are small, slightly elevated areas of Morey soils. Included areas make up less than 3 percent of the mapped acreage.

This Lake Charles soil is used mainly for crops and improved pasture. Some small areas are used as native range, and trees grow in some areas. Capability unit IIw–1; Blackland range site; pasture and hay group 7A; woodland suitability group 2w8; Blackland woodland grazing group.

Lake Charles clay, 1 to 5 percent slopes (LaB).—This soil is on narrow side slopes that lead to natural drainageways. Areas are 10 to 200 acres in size. Slopes are mostly 4 percent.

The surface layer is black clay about 14 inches thick. The next layer is mottled, very dark gray clay that reaches to a depth of 36 inches. Below this is mottled, yellowish-brown and olive-brown clay that extends to a depth of 60 inches.

Included with this soil in mapping are narrow areas, less than 5 acres in size, of Harris clay that are near the bottom of slopes. Also included are a few areas of Lake Charles clay that have slopes of as much as 8 percent.

This Lake Charles soil is used mainly as improved pasture and range. In most places it is dry during part of July and August. Some small areas are used for crops and trees. Capability unit IIIe–1; Blackland range site; pasture and hay group 7A; woodland suitability group 2w8; Blackland woodland grazing group.

McKamie Variant

The McKamie variant consists of deep, gently sloping, loamy soils on breaks to natural drainageways. These acid soils formed in thick beds of old sandy and clayey alluvium under pines and hardwoods.

In a representative profile the surface layer is fine sandy loam about 16 inches thick. It is dark brown in the upper part and yellowish brown in the lower part. The next layer is about 3 inches of mottled, yellowish-red sandy clay loam over about 11 inches of mottled, dark-red clay. Below this, to a depth of about 44 inches, is clay that is mottled with yellowish brown, red, brownish, yellow, and gray. The next layer is mottled, yellowish-brown sandy clay loam that extends to a depth of about 70 inches.

McKamie soils are well drained. Permeability is very slow, and available water capacity is high. Runoff is medium to very rapid, and internal drainage is slow.

Representative profile of McKamie fine sandy loam, wet variant, 1 to 5 percent slopes, 6 miles north of Anahuac on Farm Road 563, then 1.3 miles west on a county road and 50 feet north of the road:

A1—0 to 6 inches, dark-brown (10YR 4/3) fine sandy loam,

pale brown (10YR 6/3) dry; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; few, fine, fibrous roots; slightly acid; clear, wavy boundary.

A2—6 to 16 inches, yellowish-brown (10YR 5/4) fine sandy loam, very pale brown (10YR 7/3) dry; weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; few, fine, fibrous roots; slightly acid; clear, wavy boundary.

B1t—16 to 19 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 5/6) dry; few, fine, faint mottles of reddish yellow and grayish brown; weak, fine, angular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; few clay films; slightly acid; clear, wavy boundary.

B21t—19 to 30 inches, dark-red (10R 3/6) clay, red (10R 4/6) dry; few, fine, faint mottles of yellowish red and grayish brown; moderate, fine, angular blocky structure; hard, friable, sticky and plastic; few fine roots; clay film on outside of peds; medium acid; gradual, wavy boundary.

B22t—30 to 44 inches, mottled, 55 percent red (2.5YR 4/8), 40 percent yellowish-brown (10YR 5/4), and 5 percent brownish-yellow (10YR 6/8) and gray (10YR 6/1) clay; moderate, fine, angular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; very strongly acid; gradual, wavy boundary.

B3—44 to 70 inches, yellowish-brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; many, medium and coarse, prominent mottles of yellowish red (5YR 4/8) and red (2.5YR 4/8) and few, fine, distinct mottles of brownish yellow and gray; weak, fine, angular blocky structure; hard, friable, slightly sticky and plastic; very strongly acid.

The A horizon ranges from 12 to 16 inches in thickness. It ranges from dark brown or light brownish gray to light yellowish brown and from strongly acid to slightly acid.

The B horizon ranges from dark yellowish brown to yellowish red or dark red and from very strongly acid to medium acid. The Bt horizon is 35 to 45 percent clay. The B2t horizon ranges from 20 to 42 inches in thickness. The B3 horizon is sandy clay loam, fine sandy loam, or fine sand.

McKamie fine sandy loam, wet variant, 1 to 5 percent slopes (McB).—This soil is in areas 5 to 20 acres in size. Included with this soil in mapping are areas, less than 5 acres in size, of soils that have a sandy surface layer 40 to 72 inches thick and lower layers of yellowish-red sandy clay loam. Also included are some areas of McKamie soils that have slopes of as much as 8 percent and some areas of this soil, that are underlain at a depth of 60 inches by several feet of fine and coarse sandy material. Included areas make up less than 15 percent of the mapped acreage.

This McKamie soil is used mostly for improved pasture and timber production. Some small areas are cultivated, and many areas have been excavated for fill sand. Capability unit IVe–1; pasture and hay group 8C; woodland suitability group 2o7; Sandy Loam woodland grazing group.

Morey Series

The Morey series consists of deep, nearly level, loamy soils. These acid soils formed in deltaic alluvium under tall prairie grasses and sedges. Slopes are less than 1 percent and are plane and smooth.

In a representative profile the surface layer is very dark gray silt loam about 9 inches thick. The next layer is about 3 inches of very dark gray silt loam over mottled, dark-gray silty clay loam that extends to a depth of 32 inches. Below this is mottled, grayish-brown and gray silty clay loam that extends to a depth of about 64 inches.

Morey soils are poorly drained. Permeability is slow, and available water capacity is high. Runoff and internal drainage are slow or very slow.

Representative profile of Morey silt loam, levelled, 10 miles east of Anahuac on Texas Highway 65, then 1.8 miles south on Farm Road 1941, then 0.9 mile east on a county road and 200 feet north of the road:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak, fine, granular structure; very hard, friable, slightly sticky and plastic; common, fine, fibrous roots; few fine pores; few strong-brown stains on surface of root channels; few wormcasts; medium acid; clear, smooth boundary.

B1—9 to 12 inches, very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak, medium, angular blocky structure; very hard, firm, slightly sticky and plastic; few, fine, fibrous roots; very few fine pores; few dark-brown stains on surface of root channels; slightly acid; gradual, smooth boundary.

B21tg—12 to 22 inches, dark-gray (10YR 4/1) silty clay loam, gray (10YR 5/1) dry; few, fine, distinct, yellowish-brown mottles mostly inside peds; moderate, medium, blocky structure; very hard, firm, sticky and plastic; few, fine, fibrous roots mostly between peds; thin clay films on peds; neutral; gradual, wavy boundary.

B22tg—22 to 32 inches, dark-gray (10YR 4/1) silty clay loam, gray (10YR 5/1) dry; few, fine, faint, yellowish-brown mottles; moderate, medium, blocky structure; very hard, firm, sticky and plastic; few, fine, fibrous roots; almost continuous clay films; few fine and very fine pores mostly inside peds; very dark gray coating on surface of some peds; neutral; gradual, wavy boundary.

B31tg—32 to 42 inches, grayish-brown (2.5Y 5/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; common, fine and medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, blocky structure; very hard, firm, sticky and plastic; very few fine roots and pores; few clay films on peds; common krotovinas of gray clay 1 to 1½ inches in diameter and 1 foot apart; mildly alkaline; gradual, wavy boundary.

B32tg—42 to 52 inches, gray (10YR 5/1) silty clay loam, gray (10YR 6/1) dry; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, blocky structure; very hard, firm, sticky and plastic; very few fine roots and very fine pores; few slickensides that do not intersect; few krotovinas of gray clay about 1 foot apart; few weakly cemented concretions of ferromanganese; moderately alkaline; gradual, wavy boundary.

B33tg—52 to 64 inches, gray (5Y 5/1) silty clay loam, light gray (5Y 6/1) dry; common, fine, distinct, yellowish-brown mottles; weak, medium, blocky structure; very hard, sticky and plastic; many pockets of very dark gray (10YR 3/1) silt loam, apparently krotovinas; many concretions of calcium carbonate up to 2 inches in diameter; moderately alkaline.

The A horizon ranges from 9 to 14 inches in thickness. It ranges from massive (structureless) to weak, granular structure in some rice fields. It ranges from very dark gray to black, has as much as 15 percent mottles, and ranges from medium acid to neutral.

The B1 horizon ranges from very dark gray to black. The Bt horizon is 25 to 35 percent clay. The B2tg horizon is gray or dark gray, has 5 to 20 percent mottles, and ranges from slightly acid to mildly alkaline. The B3tg horizon is gray or light olive gray, has common to many yellowish-brown mottles, and ranges from slightly acid to moderately alkaline. The B horizon in the lower part has few to common calcium carbonate concretions.

Morey silt loam, levelled (Mo).—This soil is in areas 5 to 600 acres in size. Slopes are less than 1 percent.

Originally, this soil was on low, sandy, circular mounds 20 to 50 feet in diameter and 1 to 3 feet high, but in most places these have been leveled. Where some of the sandy mounds have been smoothed, slightly saline horizons have been exposed. These areas appear as slick-spots in fields.

Included with this soil in mapping are areas that have not been leveled and some low areas of Beaumont and Lake Charles soils less than 5 acres in size. Sandy mounds make up 2 to 20 percent of the unleveled areas. Also included are a few areas of soils similar to Morey soils, but they have a surface layer of clay loam or very fine sandy loam. In most places, included areas make up less than 5 percent of the mapped acreage, but in a few places they make up as much as 20 percent. All included areas make up less than 10 percent of the total mapped acreage.

This Morey soil is used mainly for crops, and all crops suited to the county are grown. Some areas are used as improved pasture and range, and a few places are in trees. Capability unit IIIw–3; Loamy Prairie range site; pasture and hay group 7C; woodland suitability group 2w8; Flatwoods woodland grazing group.

Psamments

Psamments consist of sandy soils on mounds. These soils are too variable to classify at the series level. They are classified at the suborder level rather than as a miscellaneous land type because there is sufficient information for some interpretations.

The soils have apparently been deposited by wind or water, or both, over loamy and sandy soils. The upper part of the soil is very dark gray loamy fine sand over grayish-brown loamy fine sand. The buried soils are very dark gray fine sandy loam, silt loam, or loamy fine sand over fine sandy loam or sandy clay loam.

Psamments-Clodine complex, undulating (PcB).—This mapping unit is made up of moundy and undulating areas that are 30 to 600 acres in size. It is 50 to 70 percent Psamments, 25 to 45 percent Clodine soils, and 5 to 10 percent other soils.

The Psamments are on circular mounds that are 1 to 4 feet high and 50 to 75 feet in diameter. Short slopes on the mounds are as much as 5 percent. The Clodine soils are in low, depressional areas between the mounds. Water stands on the surface of the Clodine soils during the cool winter months, but the Psamments are seldom saturated. The soils are inundated during Gulf storms and are saturated during very high tides.

Clodine soils have a surface layer of dark-gray loam, sandy clay loam, or fine sandy loam about 5 inches thick. The next layer is 11 inches of mottled, light-gray silt loam. Below this, to a depth of 70 inches, is mottled, gray sandy clay loam.

In some places the vegetation has been burned while the soils were dry. The burning has removed much of the dark coloring from the surface layer, and in burned areas the surface layer is light gray or white.

Included with these soils in mapping are depressional areas of Harris clay that are less than 5 acres in size.

Areas of this mapping unit require extensive reclamation projects, such as levees and pumpoff drainage systems, before they can be cultivated. They are well suited to range and wildlife habitat. A few areas are used for improved pasture. Capability unit VIs–1; Psamments part in Coastal Sand range site, and Clodine part in Salt Marsh range site; pasture and hay group 7G.

Stowell Series

The Stowell series consists of deep, nearly level, sandy soils on low ridges. These acid soils formed in thick deposits of loamy and sandy material under prairie bunchgrasses. Slopes are less than 1 percent and are convex.

In a representative profile the surface layer is very dark gray loamy fine sand about 15 inches thick. The next layer is loamy fine sand about 27 inches thick. It is dark grayish brown in the upper 9 inches, grayish brown in the next 8 inches, and light brownish gray and mottled in the lower 10 inches. Below this is mottled, yellowish-brown fine sandy loam underlain by mottled, gray sandy clay loam that extends to a depth of about 78 inches.

Stowell soils are somewhat poorly drained. Permeability is moderately rapid above the water table, and available water capacity is low. Runoff is slow, and internal drainage is slow to rapid.

Representative profile of Stowell loamy fine sand, 6.3 miles northeast of Smith Point on Farm Road 562 and 200 feet north of the road:

A1—0 to 15 inches, very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine grass roots; medium acid; clear, smooth boundary.

A21—15 to 24 inches, dark grayish-brown (10YR 4/2) loamy fine sand, light brownish gray (10YR 6/2) dry; very weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; few fine grass roots; few very dark grayish-brown (10YR 3/2) streaks in old root channels; medium acid; clear, smooth boundary.

A22—24 to 32 inches, grayish-brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; single grained; loose, very friable, nonsticky and nonplastic; few fine grass roots; medium acid; clear, wavy boundary.

A23—32 to 42 inches, light brownish-gray (10YR 6/2) loamy fine sand, light gray (10YR 7/2) dry; few, fine, faint, brownish-yellow mottles; single grained; loose, very friable, nonsticky and nonplastic; uncoated sand grains; strongly acid; abrupt, wavy boundary.

B21t—42 to 47 inches, yellowish-brown (10YR 5/7) fine sandy loam, brownish yellow (10YR 6/7) dry; many, medium, distinct, gray (10YR 6/1) and few, fine, faint, strong-brown mottles; weak, fine and very fine, angular blocky structure; firm, hard, slightly sticky and plastic; few fine root channels; few clay films on surface of peds; strongly acid; clear, smooth boundary.

B22t—47 to 60 inches, gray (10YR 6/1) sandy clay loam, light gray (10YR 7/1) dry; many, medium, distinct, yellowish-brown (10YR 5/7) mottles; weak, fine, angular blocky structure; firm, hard, slightly sticky and plastic; few old root channels stained brownish yellow; clay bridging between sand grains; few clay films on surface of peds; strongly acid; diffuse, smooth boundary.

B23t—60 to 78 inches, gray (10YR 6/1) sandy clay loam, light gray (10YR 7/1) dry; many, fine and medium, distinct mottles of brownish yellow (10YR 6/8) and few, fine, distinct mottles of strong brown; weak, fine, angular blocky structure; hard, slightly

sticky and plastic; few fine roots and pores; clay bridging between sand grains; few clay films on surface of some peds; strongly acid.

The A1 horizon is very dark gray or very dark grayish brown and is strongly acid or medium acid. The A2 horizon ranges from dark grayish brown to light brownish gray and is strongly acid or medium acid. The boundary between the A23 horizon and the B21t horizon ranges from abrupt to clear and from smooth to wavy.

The B21t horizon is yellowish-brown or brownish-yellow fine sandy loam to sandy clay loam. It is strongly acid or medium acid. The B22t and B23t horizons are gray or light gray and have many brownish-yellow and yellowish-brown mottles.

Stowell loamy fine sand (St).—This soil is in areas 10 to 1,000 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small, circular, depressional areas of Frost soils that are surrounded by Stowell soil in most places and are very difficult to drain. Also included are areas of Frost soils in long, narrow, old, winding streambeds. Included areas make up less than 10 percent of the mapped acreage.

This Stowell soil is used mostly as range and improved pasture. Some areas are used for tree production, and small areas are cultivated. Capability unit IIIw–4; Coastal Sand range site; pasture and hay group 9C; woodland suitability group 2s2; Sandy woodland grazing group.

Stowell-Clodine complex, undulating (SwB).—This mapping unit is made up of undulating soils in areas 10 to 400 acres in size. Stowell loamy fine sand makes up 45 to 65 percent of the mapping unit, Clodine soil 25 to 45 percent, and other soils 5 to 10 percent.

Stowell loamy fine sand is on slightly elevated mounds and ridges. The mounds are 50 to 200 feet in diameter, and the ridges are 100 to 300 feet wide and 400 to 800 feet long. This soil has a surface layer of very dark gray loamy fine sand about 15 inches thick. The next layer is light brownish-gray loamy fine sand about 30 inches thick. It is mottled in the lower part. Below this is yellowish-brown sandy clay loam about 8 inches thick. The underlying material is mottled, gray sandy clay loam that extends to a depth of 70 inches.

Clodine soil is in areas that wind around the Stowell soil, and in some places it is in circular depressional areas. Areas are 10 to 300 feet wide and are connected throughout. This soil has a surface layer of very dark gray sandy clay loam, loam, or fine sandy loam about 5 inches thick. The next layer is mottled, dark-gray and gray sandy clay loam about 46 inches thick. Below this is light olive-gray clay that extends to a depth of 70 inches.

Included with these soils in mapping are areas of level Frost and Harris soils and of a Stowell soil that has slopes as much as 5 percent.

Areas of this mapping unit are used mostly as range. They are not suitable for cultivation without extensive reclamation, such as levees for protection and pumpoff systems for drainage. Water stands on the surface of the Clodine soil during the cool months. Salinity of the Clodine soil is slight or moderate. A few areas are in improved pasture. Capability unit VIs–1; Stowell part in Coastal Sand range site, and Clodine part in Salt Marsh range site; pasture and hay group 9C.

Vaiden Series

The Vaiden series consists of deep, nearly level or gently sloping, clayey soils. These acid soils formed in thick beds of acid to calcareous clay and were under a mixed cover of pine and hardwood trees, at least during the latter part of their formation. They have a pronounced gilgai microrelief.

In a representative profile the surface layer is mottled, very dark grayish brown clay about 4 inches thick. The next layer is clay about 40 inches thick that is mottled in shades of gray, brown, and yellow. Below this is mottled, gray clay that extends to a depth of 60 inches.

Vaiden soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and internal drainage is slow or very slow.

Representative profile of Vaiden clay, 0 to 1 percent slopes, 4.3 miles northeast of Anahuac on Texas Highway 61, then 0.4 mile east on a logging road and 100 feet south of the road:

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; few, fine, faint, gray (10YR 5/1) mottles; weak, fine, angular blocky and granular structure; hard, firm, very sticky and plastic; common fine roots and wormcasts; medium acid; clear, wavy boundary.

AC1—4 to 12 inches, prominently and coarsely mottled, gray (10YR 5/1) and brownish-yellow (10YR 5/6) clay, gray (10YR 6/1) and yellowish brown (10YR 6/6) dry; few, fine, distinct, strong-brown mottles; moderate, fine, angular and subangular blocky structure; very hard, firm, very sticky and plastic; few, fine and coarse, woody roots; few ferromanganese concretions 3 millimeters in diameter; few wormcasts; medium acid; clear, wavy boundary.

AC2—12 to 24 inches, distinctly and coarsely mottled, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) clay, light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/6) dry; few, fine, distinct, strong-brown mottles; coarse intersecting slickensides; moderate, medium, angular blocky structure; very hard, very firm, very sticky and plastic; few, fine and medium woody roots; few shiny pressure faces; cracks 1 inch wide; few ferromanganese concretions 3 millimeters in diameter; medium acid; clear, wavy boundary.

AC3g—24 to 44 inches, mottled, gray (2.5Y 6/1) and yellowish-brown (10YR 5/8) clay, light gray (2.5Y 7/1) and brownish yellow (10YR 6/8) dry; coarse intersecting slickensides; moderate, medium, angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots and pores; shiny pressure faces; cracks 1 inch wide and 10 inches apart extend through horizon; medium acid; clear, wavy boundary.

Cg—44 to 60 inches, gray (2.5Y 6/1) clay, light gray (2.5Y 7/1) dry; many, fine and medium, distinct mottles of brownish yellow (10YR 5/6) and few, fine, prominent mottles of yellowish red (5YR 4/8); coarse intersecting slickensides; weak, medium, angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; shiny pressure faces; slightly acid.

The profile has few to many black concretions of ferromanganese throughout.

The A horizon ranges from 0 to 4 inches in thickness, from very dark gray to brown in color, and from very strongly acid to medium acid in reaction. The AC horizon ranges from brown to brownish yellow and has distinct and prominent mottles in shades of gray, yellow, brown, and red. It ranges from very strongly acid to mildly alkaline.

The C horizon is mottled in shades of gray, yellow, brown, and red, or it is mottled and has a matrix color of gray.

Vaiden clay, 0 to 1 percent slopes (VaA).—This soil is in areas 10 to 300 acres in size. It has the profile described as representative of the series. Slopes are less than 1 percent.

Included with this soil in mapping are long, narrow, depressional areas of Acadia and Calhoun soils that are less than 10 acres in size. Also included are areas where the surface layer is silt loam; unburned, wooded areas where the surface is covered with a layer of twigs and leaves that is 1 to 3 inches thick; and smoothed areas where brightly mottled lower layers are exposed. Included areas make up less than 5 percent of the mapped acreage.

This Vaiden soil is used mostly for trees, but it is also used for crops, native range, and improved pasture. Capability unit IIIw–1; Blackland range site; pasture and hay group 7A; woodland suitability group 2w8; Blackland woodland grazing group.

Vaiden clay, 1 to 5 percent slopes (VaB).—This soil is on narrow side slopes that lead to low terraces and flood plains of natural drainageways. Areas are 10 to 200 acres in size. Slopes are 1 to 5 percent.

The surface layer is brown clay about 4 inches thick. The next layer is clay that reaches to a depth of 42 inches. It is mottled in shades of gray, brown, yellow, and red. Below this is mottled, gray clay that extends to a depth of 60 inches.

Included with this soil in mapping are areas of Acadia silt loam that are less than 30 acres in size and areas of Vaiden clay that has slopes of as much as 12 percent. Included areas make up less than 10 percent of the mapped acreage.

This Vaiden soil is used mostly for trees, but a few areas are used for crops and native range. Capability unit IIIe–1; Blackland range site; pasture and hay group 7A; woodland suitability group 2w8; Blackland woodland grazing group.

Veston Series

The Veston series consists of deep, nearly level, loamy soils. These alkaline and saline soils formed under water-loving and salt-tolerant grasses and sedges in loamy marine sediment that was deposited by storm tides and wind action. Slopes are less than 1 percent and are slightly convex.

In a representative profile the surface layer is about 12 inches thick. It is mottled, dark-gray silt loam in the upper 8 inches and very dark gray silty clay loam in the lower 4 inches. The next layer, to a depth of 28 inches, is mottled, dark-gray silty clay loam that is stratified with fine sandy loam, silt loam, or clay loam. Below this is mottled, gray silty clay loam that is stratified with loam, silt loam, and fine sandy loam. This layer extends to a depth of about 63 inches.

Veston soils are poorly drained. Permeability is moderate above the water table. Available water capacity is low or moderate, depending on salinity. Runoff is very slow, and internal drainage is slow.

Representative profile of Veston silt loam in an area of Veston soils, 17.6 miles south of Winnie on Texas Highway 124, then 1.6 miles east on Texas Highway 87 and 300 feet north of the highway:

A11g—0 to 8 inches, dark-gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; thin sandy clay loam strata less than 2 inches thick; few, fine, distinct mottles of strong brown; weak, fine, subangular blocky structure; very hard, friable, slightly sticky and plastic; common grass roots; saline; moderately alkaline; abrupt, wavy boundary.

II A12g—8 to 12 inches, very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate, fine and very fine, subangular blocky structure; hard, firm, sticky and plastic; common fine grass roots; saline; moderately alkaline; clear, smooth boundary.

II B21g—12 to 28 inches, dark-gray (10YR 4/1) silty clay loam, gray (10YR 5/1) dry; thin strata of fine sandy loam, silt loam, or clay loam; common, fine, distinct, yellowish-brown and strong-brown mottles; weak, fine and medium, angular and subangular blocky structure; few fine grass roots; strong-brown mottles along root channels; few fine pores; few weakly cemented concretions of ferromanganese; saline; moderately alkaline; diffuse, smooth boundary.

II B22g—28 to 63 inches, gray (10YR 5/1) silty clay loam, gray (10YR 6/1) dry; thin strata of loam, silt loam, and fine sandy loam; few to common, yellowish-brown, strong-brown, and light olive-brown mottles; weak, medium, angular blocky structure; very hard, very firm, sticky and plastic; few fine roots; few clusters of gypsum crystals; few medium concretions of ferromanganese; few calcium carbonate concretions; saline; moderately alkaline.

The profile is extremely variable in number, thickness, and texture of horizons. Any given horizon ranges from silty clay loam to fine sandy loam. The A1g and B2g horizons range from very dark gray to gray and are mottled in shades of gray, olive, yellow, and brown. They are moderately alkaline or strongly alkaline and have few to many shell fragments that range from ⅛ inch to 3 inches in diameter. At a depth of 10 to 40 inches, the soil is 19 to 26 percent clay.

The Veston soils in Chambers County are outside the range of the Veston series. They have a mean annual temperature, at a depth of 20 inches, of slightly less than 72° F. This difference, however, does not alter their use or management.

Veston soils (Ve).—These soils are in areas 3 to 100 acres in size.

Included with these soils in mapping are a sandy beach 30 to 50 feet wide and about 1 mile long and a narrow strip of sandy soils that support vegetation but are affected by high tides, Gulf storms, and salt spray. These areas have as much as 40 inches of sandy material over soils similar to Veston soils. Also included are some areas of Veston soils that have loamy fine sand at a depth of 15 inches. Included areas make up less than 15 percent of the total mapped acreage.

These Veston soils are too salty, too wet, and too frequently damaged by storms to be cultivated or used for woodland production or improved pasture. They are better suited to range, wildlife habitat, or recreation than to most other uses. Capability unit VIIw–2; Salty Prairie range site.

Use and Management of the Soils

This section describes basic practices that can be used in managing soils for cultivated crops, pasture, range, wooded areas, and wildlife habitat. Also discussed in this section are the predicted average yields of principal crops and the engineering properties and interpretations of the soils.

Management of Cultivated Soils[2]

Drainage, conserving soil moisture, and maintaining soil tilth and fertility are the main objectives of management of cultivated soils in Chambers County.

A good cropping system maintains or improves soil tilth; protects the soil during heavy rains, droughts, and strong winds; aids in the control of weeds, insects, and plant diseases; and provides an adequate economic return. In a system of this kind, crops are grown in a sequence or rotation so that soil-improving crops balance soil-depleting ones.

A large amount of crop residue left on or near the surface protects the soil against packing rains, reduces crusting, increases water intake, decreases runoff, and reduces evaporation. It also adds organic matter to the soil, improves soil tilth, and reduces compaction by farm machinery. Nitrogen fertilizer applied to crop residue causes it to decay more rapidly and prevents a tie-up of available nitrogen for the next crops in the rotation.

Drainage systems, such as main and lateral ditches, field ditches, planned row direction, or rice field outlets, should be planned so that the use of farm equipment is not inhibited. Because adequate outlets for water are difficult to locate, they should be considered first when drainage systems are designed and planned.

An irrigation system should distribute the right amount of water at the time and place it is needed. Uniformity and ease of water application also are important. Where saltwater intrusions or a low water supply are concerns, the system should include reservoirs or wells to supplement the water supply.

Most soils in Chambers County respond to some type of fertilization. The use of commercial fertilizers and lime should be based on crop needs as determined by soil tests. The amount and type of fertilizer needed vary according to the nature of the soil, the crop to be grown, the production desired, the previous land use, the season of the year, and the amount of available water. For row crops it is best to band fertilizers below and to the side of the seed. For rice and other broadcast crops, broadcasting of fertilizer is best.

The soils in this county should be tilled only enough to prepare a good seedbed and to control weeds. Excessive tillage or tillage when the soil is wet damages the soil structure and causes a plowpan to form. Poor structure limits water intake and reduces the air space in the soil. A plowpan restricts root growth, slows water penetration, and causes an increase in runoff.

Terraces can be designed to reduce runoff or to divert excess water from cultivated land or other areas that need protection. Sloping cultivated fields need the protection of channel-type terraces that divert water to a pasture, meadow, or protected waterway. Terraces are more efficient when they are parallel to each other and the grade is uniform. Farming on the contour, parallel to the terraces, protects the terrace system.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, the kinds of soils are grouped at three levels: the class, subclass, and unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in Chambers County)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture, range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, water supply, or to use for esthetic purposes. (None in Chambers County)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States (not in this county), shows that the chief limitation is climate that is too cold or too dry.

Class I has no subclasses because the soils of this class have few limitations. Class V can contain, at the

[2] A. L. PACE, agronomist, Soil Conservation Service, assisted in the preparation of this section.

most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion. These soils have other limitations, however, that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw–1 or IIIe–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following paragraphs each capability unit in Chambers County is described, and suggestions for the use and management of the soils are given. To find the name of the soil in any capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT IIw–1

Lake Charles clay, 0 to 1 percent slopes, is the only soil in this unit.

Water frequently stands on the surface or saturates this soil, and plants often are damaged by excessive moisture during wet periods. Using plants adapted to wet soils and installing drainage systems to remove excess water help to reduce the harmful effects of wetness. Land smoothing improves drainage and facilitates the application of irrigation water.

Use of cropping systems that return large amounts of organic matter to the soil improves tilth, internal drainage, and aeration. Crops grown on this soil respond to fertilizer, and the soil is well suited to irrigation.

The soil in this unit is well suited to rice. It is also suited to corn, grain and forage sorghums, cotton, small grain, and ryegrass. Some grasses and legumes suitable for pasture in rotation are bermudagrass, dallisgrass, tall fescue, longtom, ryegrass, white clover, singletary peas, alyceclover, and Hubam sweetclover.

CAPABILITY UNIT IIIe–1

This unit consists of deep, acid, clayey soils. Because these soils are gently sloping and have a clay surface layer, much rainfall is lost as runoff. Careful management is needed to maintain tilth, improve water intake, and control erosion.

Use of cropping systems that maintain large amounts of crop residue on or near the surface improves tilth, water intake, and aeration. Terracing and contour farming help to control erosion. Crops grown on these soils respond to fertilizer.

These soils are suited to cultivated crops, such as corn, grain and forage sorghums, small grain, and ryegrass. Some grasses and legumes suitable for pasture in rotation are bermudagrass, tall fescue, ryegrass, bahiagrass, lespedeza, vetch, white clover, and Hubam sweetclover.

CAPABILITY UNIT IIIw–1

This unit consists of deep, acid, nearly level, clayey soils on broad flats. Because water stands on the surface and saturates these soils, plants often are damaged by excessive moisture during wet periods. Using plants adapted to wet soils and installing drainage systems to remove excess water help to reduce the harmful effects of wetness. Land smoothing improves drainage and facilitates the application of irrigation water.

Use of cropping systems that return large amounts of organic matter to the soil improves tilth (fig. 8). These soils are well suited to irrigation.

The soils in this unit are well suited to rice. They are also suited to corn, grain and forage sorghums, small grain, and ryegrass. Some grasses and legumes suitable for pasture in rotation are bermudagrass, dallisgrass, tall fescue, longtom, ryegrass, white clover, singletary peas, and Hubam sweetclover.

CAPABILITY UNIT IIIw–2

This unit consists of deep, acid, loamy soils that are nearly level or depressional. Water stands on the surface and saturates these soils. Using plants adapted to wet soils and installing drainage systems to remove excess water help to reduce the harmful effects of wetness. Land smoothing improves drainage and facilitates the application of irrigation water.

Salt spots are at the base of some of the mounds in this unit. When the mounds are smoothed, these salt spots are exposed at the surface. The salty material should be removed, and the area filled with salt-free soil.

Use of cropping systems that maintain large amounts of crop residue on or near the surface improves tilth and aeration. Crops grown on these soils respond to fertilizer. Agricultural limestone is also needed in some places. These soils are well suited to irrigation.

The soils in this unit are well suited to rice. They are also suited to corn, grain and forage sorghums, ryegrass, and small grain. Some grasses and legumes suitable for pasture in rotation are bermudagrass, dallisgrass, tall fescue, bahiagrass, ryegrass, white clover, singletary peas, lespedeza, and Persian clover.

CAPABILITY UNIT IIIw–3

This unit consists of deep, acid, loamy soils that are nearly level.

During dry periods, plants are often damaged by lack of moisture. Using early-maturing, drought-resistant, and cool-season crops helps to reduce the harmful effects of droughtiness. During rainy seasons, water stands on the surface and saturates these soils for long periods. Plants are often damaged by excessive moisture. Using plants adapted to wet soils and installing drainage systems to remove excess water help to reduce the harmful effects of wetness. Land smoothing improves drainage and facilitates the application of irrigation water.

Low, sandy, circular mounds are in many places. Salt spots that contain enough salt to offset plant growth are at the base of some of these mounds. When the

Figure 8.—**Incorporating crop residue in Beaumont clay prior to planting rice.**

mounds are smoothed, these salt spots are exposed at the surface. The salty material should be removed, and the areas filled with salt-free soil.

Use of cropping systems that maintain large amounts of crop residue on or near the surface improves soil tilth and aeration. Crops grown on these soils respond to fertilizers. Agricultural limestone is needed in some places. These soils are well suited to irrigation.

The soils in this unit are well suited to rice. They are also suited to corn, grain and forage sorghums, cotton, soybeans, ryegrass, and small grain (fig. 9). Some grasses and legumes for pasture in rotation are bermudagrass, dallisgrass, tall fescue, bahiagrass, ryegrass, white clover, singletary peas, alyceclover, and crimson clover.

CAPABILITY UNIT IIIw–4

Stowell loamy fine sand is the only soil in this unit. This deep, acid, nearly level soil is on low ridges.

In rainy seasons when the water table is near the surface, plants are often damaged by excessive moisture. During dry seasons, plants are often damaged by lack of moisture. Using plants adapted to wet soils in cool seasons and plants adapted to droughty soils in warm seasons helps to reduce the harmful effects of these conditions.

Use of cropping systems that maintain large amounts of crop residue on or near the surface improves tilth and reduces erosion. Crops grown on this soil respond to fertilizer. Agricultural limestone is needed where legumes are planted.

This soil is suited to cultivated crops, such as corn, grain and forage sorghums, truck crops, and small grain. Some grasses and legumes suitable for pasture in rotation are bermudagrass, tall fescue, ryegrass, bahiagrass, lespedeza, vetch, and crimson clover.

CAPABILITY UNIT IVe–1

McKamie fine sandy loam, wet variant, 1 to 5 percent slopes, is the only soil in this unit. This soil is deep and acid. Because of slope, the hazard of erosion is high where this soil is unprotected. Careful management is needed to maintain tilth and to control erosion. Early-maturing, drought-resistant, and cool-season crops are well suited to this soil.

Use of cropping systems that maintain large amounts of crop residue on or near the surface improves tilth and reduces erosion. Terracing and contour farming help to control erosion. Crops grown on this soil respond to fertilizer. Agricultural limestone is needed where legumes are grown.

This soil is suited to cultivated crops, such as corn, grain and forage sorghums, truck crops, and small grain. Some grasses and legumes suitable for pasture in rotation are bermudagrass, tall fescue, ryegrass, bahiagrass, lespedeza, vetch, and crimson clover.

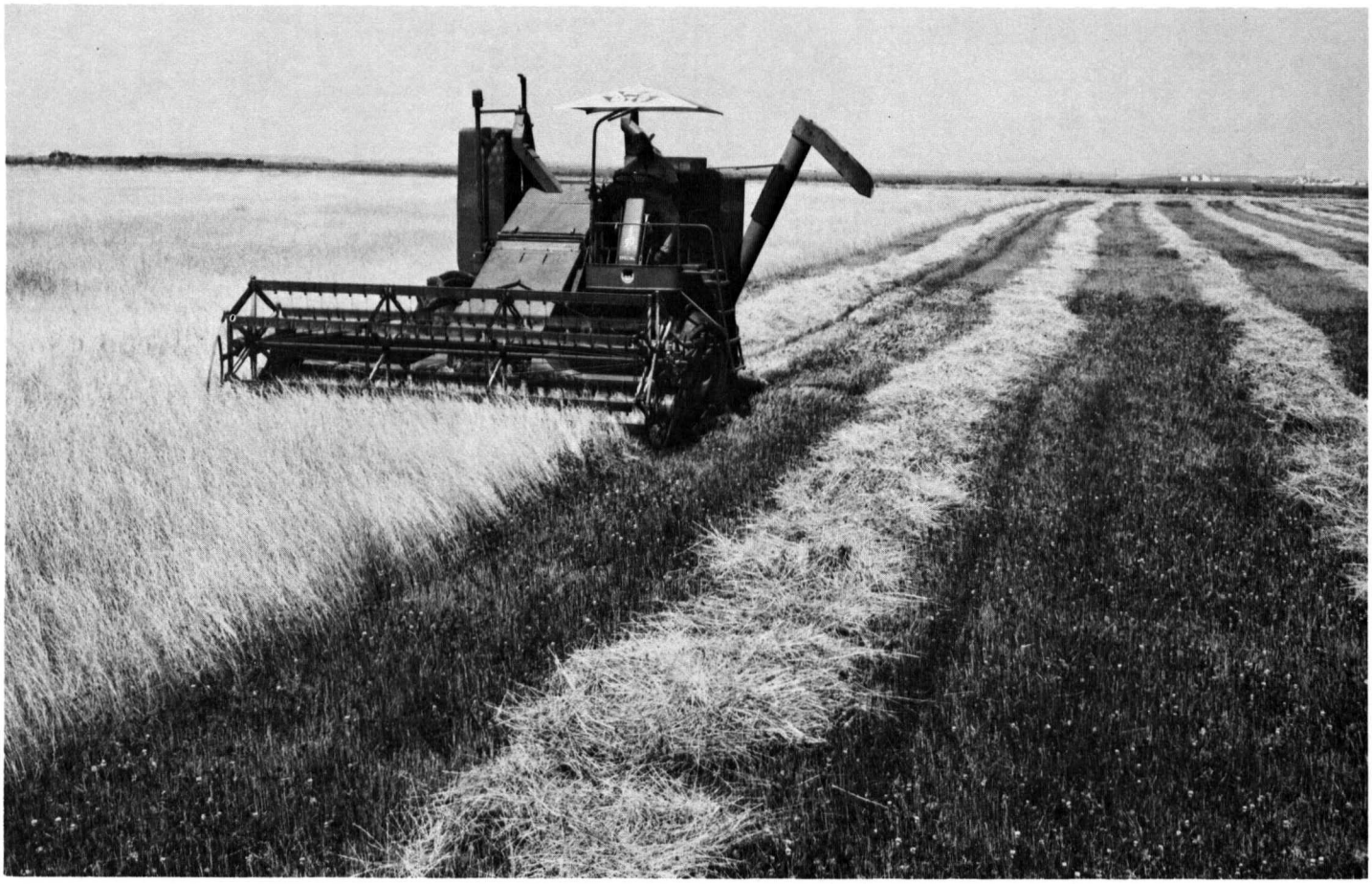

Figure 9.—**Harvesting ryegrass seed on Anahuac silt loam.**

CAPABILITY UNIT Vw–1

Kaufman clay, frequently flooded, is the only soil in this unit (fig. 10). This deep, alkaline, nearly level soil is on flood plains.

This soil is better suited to pasture, range, woodland, or wildlife habitat than to most other uses.

CAPABILITY UNIT VIs–1

This unit consists of deep, acid to alkaline, loamy to sandy soils that are nearly level and undulating.

These soils are better suited to range, pasture, or wildlife habitat than to most other uses.

CAPABILITY UNIT VIIw–1

Harris clay is the only soil in this unit. This deep neutral soil is in flat or depressional areas.

The soil is wet and salty and is frequently damaged by storms. It is better suited to range or wildlife habitat than to most other uses.

CAPABILITY UNIT VIIw–2

This unit consists of deep, nearly level, saline and alkaline soils that are loamy and clayey.

These soils are frequently damaged by storms and high tides. They are better suited to range, wildlife habitat, or recreation than to most other uses.

Predicted yields

The predicted average yields that can be expected from crops grown on soils of Chambers County under a high level of management are given in table 2. The estimates are based on information gathered through interviews with farmers, county agricultural workers, and others who have observed or maintained yield records in the county.

Soils not listed in the table are either not normally used to grow the crops or are not suitable for cultivation.

To obtain the yields given in table 2, the following management practices are used:

1. Consistent use of soil-improving crops, cover crops, high-residue crops, or improved pastures in the rotation.
2. Proper management of crop residue.
3. Installation and maintenance of adequate drainage systems, including land smoothing where necessary.
4. Installation and maintenance of adequate irrigation systems in rice fields, including good quality water supply.
5. Timely application of fertilizer in amounts determined by soil and crop needs.
6. Timely tillage, seeding, and harvesting.
7. Timely control of weeds, insects, and plant disease.

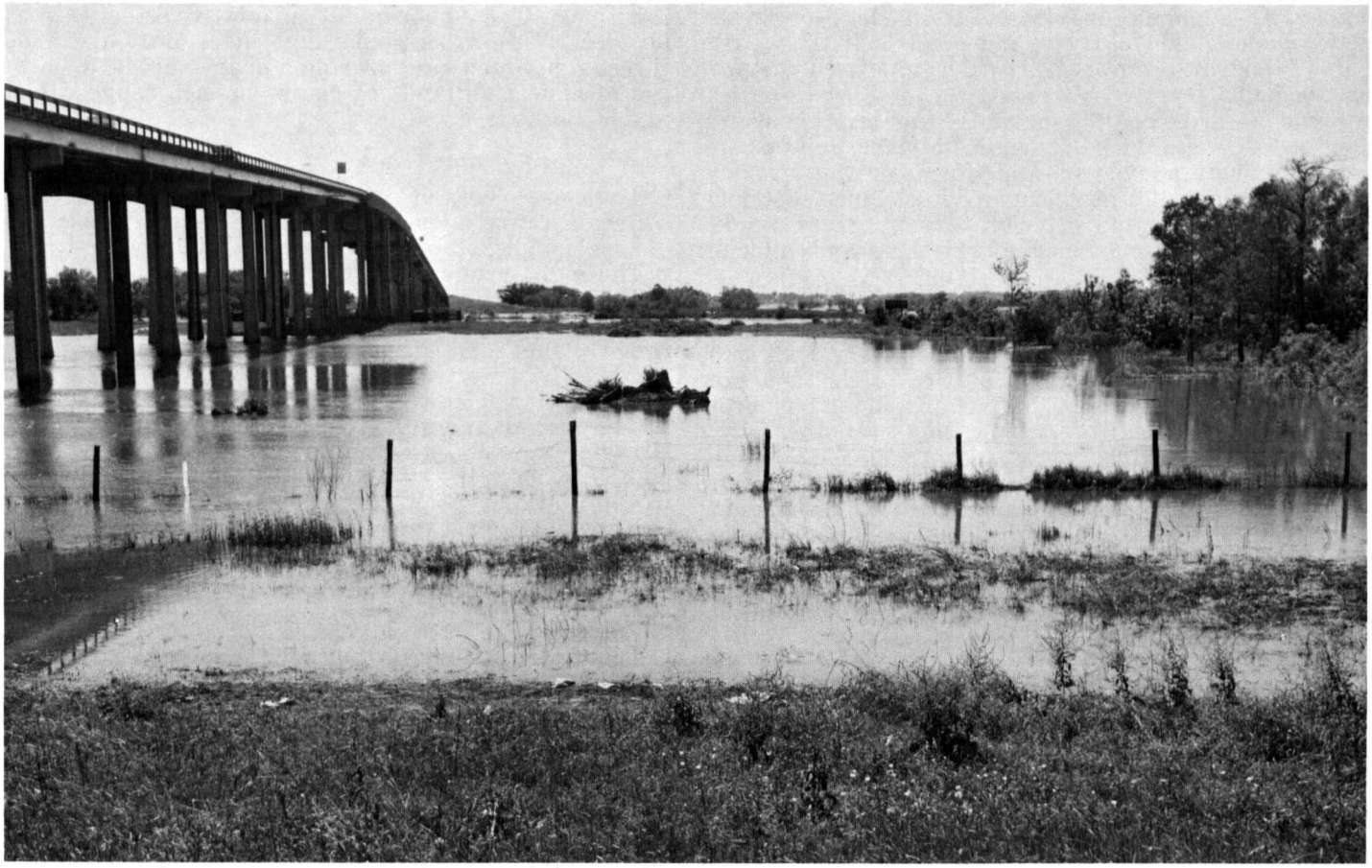

Figure 10.—**Area of Kaufman clay, frequently flooded.**

8. Selection of and timely planting of proven crop varieties.

Range[3]

Range is land on which the climax plant community is composed principally of grasses, grasslike plants, forbs, and shrubs that are valuable for grazing and are available in sufficient quantity to justify grazing use. Few ranchers depend on range alone for yearlong grazing. To improve their grazing and feeding programs, ranchers normally use supplemental pasture and improved permanent pasture, and they feed supplements to the cattle.

Ranching and livestock farming are important enterprises in Chambers County. Range covers about 95,000 acres. The two major types of range in this county are (1) marsh range in the coastal marsh section of the county and (2) prairie range in the coastal prairie section.

Marsh range is by far the most extensive and important type of range in the county. The largest area borders East Bay and extends across the southern part of the county. These low, wet areas have water at or near the surface most of the time. The water is generally a mixture of freshwater and saltwater. The soils are saline, and the vegetation consists primarily of salt-tolerant grasses and sedges adapted to saturated soils.

The usual grazing period of marsh range is from mid-October to mid-April. Except during severe storms or cold, wet weather, cattle do well on the range in

[3] KENNETH D. SPARKS, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

TABLE 2.—*Predicted average yields per acre of principal crops grown under a high level of management*

[Soils not listed are not normally used for crops or are not suited to cultivation]

Soil	Rice	Corn	Forage sorghum	Grain sorghum
	Lbs	*Bu*	*Tons*	*Lbs*
Anahuac silt loam	3,900	50	3.0	2,600
Beaumont clay	4,800	30	3.0	3,000
Frost silt loam	3,800	25	1.5	2,600
Frost–Anahuac complex, undulating	3,700	30	2.5	2,600
Frost–Morey complex, levelled	4,500	30	2.5	2,600
Lake Charles clay, 0 to 1 percent slopes	5,300	45	3.5	4,200
Morey silt loam, levelled	4,800	45	3.5	3,250
Vaiden clay, 0 to 1 percent slopes	4,800	35	3.0	3,000

winter. In summer, insects and a shortage of freshwater make it necessary to move cattle from a large part of the marsh range to rice fields, improved pasture, or woodland.

Some hazards on marsh range are insects, excess flooding, diseases, lack of shelter, unstable soils where cattle can become bogged, and storms or wet freezing weather. Additional problems are inadequate distribution of grazing, rapid deterioration of fences, inadequate stock water, hazard of wildfire, and difficult access or travel.

Prairie range is of minor extent and is less important than marsh range. It is on soils of the coastal prairie and is limited to a few large ranches. Nearly all soils in prairie range are suitable for rice production. For this reason, most of the native grassland has been plowed for rice production at one time or another.

Because prairie soils are low in available phosphorus, prairie grasses produced on these soils do not contain enough phosphorus for optimum livestock production. Therefore, livestock need mineral supplements when grazing on prairie range. In addition, the forage generally is too low in protein for a balanced diet during fall and winter. Insects are abundant and harmful on prairie range.

Range sites and condition classes

The soils are classified into range sites according to the kind and amount of native vegetation that grows on a soil in any given climate. Soils in their natural condition support more than one kind of vegetation. The combination of plants that originally grew on a soil is called the potential, or climax, vegetation. Potential vegetation is the most productive combination of native plants on any given range site.

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants. The site is the product of all environmental factors responsible for its development. In the absence of abnormal disturbance and physical site deterioration, it supports a plant community that is different from that of other range sites, both in kind or proportion of plants and in total annual yield.

Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. Condition is classified as excellent, good, fair, or poor. A range site is in excellent condition if 76 to 100 percent of the plant cover is original vegetation. In good condition the plant cover is 51 to 75 percent original vegetation. In fair condition 26 to 50 percent of the plant cover is original vegetation, and on range in poor condition, not more than 25 percent of the original vegetation remains. By determining the range condition, a rancher can measure the approximate deterioration of the plant cover and has a basis for determining the amount of improvement needed.

If grazing is not managed, the better plants will be grazed so heavily that they will decrease. These high-quality native plants are referred to as decreasers. When the more palatable plants decrease in a range site, the second-choice plants tend to increase. These plants are referred to as increasers. If heavy grazing continues, the amount of second-choice plants will be reduced, and low-growing or ungrazable plants will take their place. These poor-quality plants are referred to as invaders. This process in range deterioration can be reversed by practicing grazing management. The herbage of almost all kinds of plants on each range site is usable by cattle.

Descriptions of range sites

The components of soil mapping units that serve to delineate range sites may consist of one or more soil phases, complexes, or miscellaneous land types.

The eight range sites in Chambers County are described in the following paragraphs. Each description gives significant soil characteristics, lists the principal range plants, and gives estimates of annual herbage yields to be expected if the range is in excellent condition.

Complex mapping units are also in complex range sites, for example, the mapping unit Frost-Morey complex, levelled is in two range sites. The Frost soils are in the Lowland range site, and the Morey soils are in the Loamy Prairie range site. To find the name of the soils in any range site, refer to the "Guide to Mapping Units" at the back of this survey.

BLACKLAND RANGE SITE

This range site consists of deep, clayey soils that are nearly level or gently sloping (fig. 11).

Potential vegetation is prairie-type tall grasses, such as indiangrass, switchgrass, little bluestem, big bluestem, and eastern gamagrass. In most places these plants make up about 70 to 75 percent of the forage on this site. Small amounts of Florida paspalum, longtom, brownseed paspalum, Scribner panicum, and cordgrasses also grow on this site. Button snakeroot, Maximilian sunflower, and several kinds of herbaceous legumes are valuable broadleaf forbs. Under continued heavy grazing, annual weeds, annual grasses, waxmyrtle, rattlebox, carpetgrass, and bermudagrass become thicker.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 7,250 pounds in wet years to 5,000 pounds in dry years.

BOTTOMLAND RANGE SITE

Kaufman clay, frequently flooded, is the only soil in this site. It is nearly level and deep, and it is on flood plains.

Potential vegetation is prairie-type tall grasses, such as eastern gamagrass, big bluestem, little bluestem, indiangrass, switchgrass, and Virginia wildrye. In most places these plants make up about 65 to 75 percent of the forage on this site. If the site is heavily grazed, longtom, brownseed paspalum, meadow dropseed, and perennial forbs become thicker. Bermudagrass, carpetgrass, Texas wintergrass, annual grasses, and woody brush become dominant when the taller grasses are overgrazed.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 9,800 pounds in wet years to 6,000 pounds in dry years.

COASTAL SAND RANGE SITE

This site consists of deep, nearly level and undulating, sandy soils. These soils are in areas about 3 to 8 feet higher than surrounding areas of marsh range. They

Figure 11.—**Livestock on Blackland range site in good condition. Soil is Beaumont clay.**

are affected by freshwater from rainfall and by saltwater spray during Gulf storms. The elevation and location of these soils make them valuable as range, and this site is the most likely one to be overgrazed. These soils provide higher ground for livestock when adjacent areas of marsh range are covered with water.

Potential vegetation is little bluestem, indiangrass, and gulfdune paspalum. These plants make up about 60 to 70 percent of the forage on this site. Small amounts of gulf cordgrass and marshhay cordgrass are near the outer edges of the site. Annual weeds, bermudagrass, carpetgrass, and smutgrass become thicker when little bluestem is grazed out. Under continued heavy grazing, waxmyrtle and annual weeds become dominant.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 7,000 pounds in wet years to 4,000 pounds in dry years.

LOAMY PRAIRIE RANGE SITE

This site consists of deep, level and nearly level, loamy soils. Water stands on the surface of the level soils for long periods. When these soils are covered with water, livestock graze on the sandy mounds. Therefore, this site is subject to uneven grazing.

The potential vegetation is little bluestem, indiangrass, switchgrass, brownseed paspalum, and panicum. These plants make up about 70 to 75 percent of the forage on the site. Brownseed paspalum and panicum become thicker if the site is heavily grazed. Under continued heavy grazing, carpetgrass, waxmyrtle, annual weeds, and rattlebox become dominant.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 6,500 pounds in wet years to 3,750 pounds in dry years.

LOWLAND RANGE SITE

This site consists of deep loamy soils that are nearly level or depressional.

The potential vegetation is wet, prairie-type grasses. Switchgrass is the dominant grass, and indiangrass and eastern gamagrass are abundant. These plants make up about 65 to 75 percent of the forage on this site. Longtom, longspike tridens, brownseed paspalum, and low-growing panicums become thicker if the site is heavily grazed. Under continued heavy grazing, carpetgrass, annual weeds, rattlebox, and smartweed become dominant.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 9,000 pounds in wet years to 5,000 pounds in dry years.

SALT MARSH RANGE SITE

This site consists of deep, clayey and loamy soils that are nearly level or depressional. These soils are covered with saltwater or freshwater most of the year (fig. 12). Many natural lakes, small drainageways, and large waterways are adjacent to the site.

The main potential grasses are marshhay cordgrass,

Figure 12.—Livestock on Salt Marsh range site in good condition. Soil is Harris clay.

seashore saltgrass, common reed, and big cordgrass. These plants make up about 65 to 85 percent of the forage on this site. Bushy sea-oxeye is a half shrub that grows in the more salty areas. Smooth cordgrass is abundant in small, localized areas where seawater is present. Seashore saltgrass becomes thicker if the site is heavily grazed. Under continued heavy grazing and if burning is controlled, olney bulrush, saltmarsh bulrush, California bulrush, softstem bulrush, needlegrass rush, and seashore paspalum become dominant. Salt-tolerant vegetation grows rapidly, and its excessive growth is susceptible to wildfire during dry periods.

Grazing on this site is limited by insects during the summer. Shelters placed at appropriate intervals provide protection for livestock from cold, wet, winter storms. Excavated pits and wells are needed in some areas for a reliable water supply. Cattle walkways are also beneficial (fig. 13).

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 10,000 pounds in wet years to 3,000 pounds in dry years.

SALTY PRAIRIE RANGE SITE

This site consists of deep, clayey and loamy soils that are nearly level or depressional. These soils are affected by saltwater from tides and storms and by freshwater from rainfall. Because the soils are slightly higher in elevation than adjacent soils, they provide natural walkways and resting areas for livestock when soils in other sites of marsh range are covered with water.

Gulf cordgrass makes up 70 to 80 percent of the forage on this site. Switchgrass, little bluestem, longtom, and knotroot bristlegrass also grow on this site. In areas where soil salinity is too high for prairie grasses, the vegetation is nearly all gulf cordgrass and common reed. Under continued heavy grazing and if excessive burning occurs, annual grasses and annual weeds become dominant.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 9,500 pounds in wet years to 3,000 pounds in dry years.

SANDY PRAIRIE RANGE SITE

This site consists of deep, nearly level and undulating, loamy soils. These soils provide some higher ground for livestock when many soils in other sites are wet.

The potential vegetation is little bluestem, indiangrass, switchgrass, big bluestem, brownseed paspalum, and panicums. These plants make up about 70 to 80 percent of the forage on this site. Brownseed paspalum, low-growing panicums, and gulf muhly become thicker if the site is heavily grazed. Under continued heavy grazing, carpetgrass, bermudagrass, annual weeds, waxmyrtle, and smutgrass become dominant.

Where this site is in excellent condition, the average annual yield per acre of air-dry herbage ranges from 6,000 pounds in wet years to 3,000 pounds in dry years.

Pasture and Hay

Well-managed pasture and hay meadow are essential to maintaining a balanced forage program in Chambers County.

The essential practice in pasture and hay management is grazing or cutting vegetation at intervals to maintain not only an adequate cover for soil protection

Figure 13.—**Cattle walkways, in an area of Clodine soils, aid in managing marsh range.**

but also an adequate leaf surface so that plant food for plant growth and development can be effectively manufactured. Such management practices as fertilization, weed control, and grazing in rotation are important in maintaining and improving vegetation. Fertilizer should be applied at rates recommended by a soil test and in quantities necessary for plant needs and desired forage production. The grass-legume combination in pastures can be partly regulated by the time of fertilization. Fall applications generally favor legumes, and spring applications generally favor grasses. Weed control is not so necessary on well-managed, properly used pastures as it is on poorly managed, improperly used ones. An excellent ground cover of grass prevents the growth of undesirable plants by shading and crowding them out. Late weed control can be detrimental to improved pasture plants.

A well-managed pasture generally has one dominant kind of perennial grass, has adequate fencing and cross fencing for proper rotation, has clean water, and is free of weeds. Forage production fluctuates during the growing season, and the number of livestock should be adjusted so that the dominant grass is kept at the proper height.

Pasture and hay groups

The soils in Chambers County have been placed in eight pasture and hay groups according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, to have similar limitations and hazards, to require similar management, and to have similar productivity and other responses to management. Thus, the pasture and hay group is a convenient grouping of soils for their management. The pasture and hay groups are identified by numerals and upper case letters, for example, 1A, and by adjective descriptions, such as Heavy Clayey Bottomland. The numbers and names generally are assigned locally but are part of a statewide system. Not all of the groups in the system are represented by the soils of Chambers County; therefore, the numbers are not consecutive.

The names of the soils in any group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

GROUP 1A HEAVY CLAYEY BOTTOMLAND

Kaufman clay, frequently flooded, is the only soil in this group. This soil cracks and takes in water rapidly when dry, but it expands and is very slowly permeable when wet. Seedbed preparation is difficult. Fertilizer is needed for sustained forage production.

Some grasses and legumes suitable for pasture and hay are coastal bermudagrass, common bermudagrass, dallisgrass, tall fescue, johnsongrass, gordo bluestem, angleton bluestem, white clover, burclover, buttonclover, black medic clover, vetch, singletary peas, and sweetclover.

GROUP 7A HEAVY CLAYEY UPLAND

The soils in this group are deep, clayey, and nearly level or gently sloping. These soils crack and take in water rapidly when they are dry, but they expand and are very slowly permeable when wet. Seedbed prepara-

tion is difficult. Fertilizer is needed for sustained forage production. Some areas of these soils are best suited to forage production in summer.

Some grasses and legumes suitable for pasture and hay are common bermudagrass, coastal bermudagrass, bahiagress, dallisgrass, tall fescue, johnsongrass, longtom, gordo bluestem, angleton bluestem, ryegrass, white clover, burclover, buttonclover, black medic clover, alyceclover, vetch, singletary peas, annual lespedeza, and sweetclover.

GROUP 7C FRIABLE CLAYEY UPLAND

Morey silt loam, levelled, is the only soil in this group. Fertilizer is needed for sustained forage production.

Some grasses and legumes suitable for pasture and hay are Coastal bermudagrass, common bermudagrass, bahiagrass, dallisgrass, tall fescue, johnsongrass, gordo bluestem, angleton bluestem, white clover, burclover, buttonclover, black medic clover, vetch, singletary peas, annual lespedeza, and sweetclover.

GROUP 7G LOAMY SALINE UPLAND

The soils in this group are loamy, sandy, and nearly level and undulating. These soils are affected by Gulf storms. Establishing a stand of grass from seed is difficult.

Only salt-tolerant grasses should be planted after adequate drainage systems have been installed. Such grass species as bermudagrass and torpedograss are adapted to the saline soils. Bermudagrass and bahiagrass are adapted to the more sandy soils.

GROUP 8A TIGHT LOAMY UPLAND

The soils in this group are loamy and nearly level. Fertilizer is needed for sustained forage production. Agricultural limestone is needed where legumes are grown.

Some grasses and legumes suitable for pasture and hay are Coastal bermudagrass, common bermudagrass, bahiagrass, dallisgrass, tall fescue, johnsongrass, gordo bluestem, angleton bluestem, crimson clover, arrowleaf clover, white clover, burclover, buttonclover, black medic clover, vetch, singletary peas, annual lespedeza, and sweetclover.

GROUP 8C LOAMY UPLAND

McKamie fine sandy loam, wet variant, 1 to 5 percent slopes, is the only soil in this group. Fertilizer is needed for sustained forage production. Agricultural limestone is needed where legumes are grown.

Some grasses and legumes suitable for pasture and hay are bermudagrass, weeping lovegrass, bahiagrass, crimson clover, and lespedeza.

GROUP 8E WET UPLAND

The soils in this group are loamy and nearly level or depressional. These soils are saturated for several months during most years. Because it is difficult for moisture, air, and plant roots to penetrate these saturated soils, drainage is needed before pastures can be successfully established or maintained. Fertilizer is needed for sustained forage production. Agricultural limestone is needed where legumes are grown.

Some grasses and legumes suitable for pasture and hay are Coastal bermudagrass, common bermudagrass, bahiagrass, dallisgrass, tall fescue, white clover, singletary peas, ryegrass, vetch, crimson clover, and annual lespedeza.

GROUP 9C WET SANDY UPLAND

The soils in this group are sandy and nearly level. Pasture plants respond to fertilizer during the growing season. Agricultural limestone is needed where legumes are grown.

Some grasses and legumes suitable for pasture and hay are Coastal bermudagrass, common bermudagrass, bahiagrass, arrowleaf clover, ball clover, hop clover, vetch, and singletary peas.

Woodland[4]

The commercial forests in Chambers County are valuable not only for cash crops but for recreational uses, seasonal grazing of livestock, and wildlife habitat.

The information in this section is based on growth-rate studies (site-index measurements) and on the judgment of woodland conservationists familiar with the area.

Protection of woodland from wildfire, harmful grazing, insects, diseases, and erosion is the first requirement for woodland management.

The Texas Forest Service provides fire protection on private lands. Prevention or control of wildfire, maintenance of access roads, construction of firebreaks, and use of controlled burning are important management practices.

Grazing should be regulated to prevent damage to stands of pine.

Insects and diseases should be controlled to insure healthy, even-growing trees. Outbreaks of insects and diseases should be reported to the Texas Forest Service.

In most places erosion is not a problem on well-managed woodland. The major causes of erosion in wooded areas are fire, excessive grazing, excessive cutting, and improper location of roads.

Dense, overstocked stands should be thinned to provide adequate space for trees to grow. Old, diseased, and other unproductive trees should be removed. Woodland that contains mostly poor or undesirable trees should be gradually converted to stands of more valuable trees.

Harvest cutting removes the mature trees, provides natural reproduction of desirable kinds of trees, and helps to eliminate the hazards of insects and diseases.

The important terms and ratings used in this section are discussed in the following paragraphs.

Site index indicates the potential productivity of forest soils. It is expressed as the average height a dominant tree will reach at 50 years of age. For example, a site index of 90 means that a dominant tree should be 90 feet tall when it is 50 years old.

Plant competition refers to the degree of competition and the rate that undesirable plants invade different soils when adequate sources of seed from these invaders are present. The ratings are (1) slight—competition from other plants is no special problem; (2) moderate—

[4] E. C. WILBUR, woodland conservationist, Soil Conservation Service, assisted in the preparation of this section.

plant competition develops but generally does not prevent establishment of an adequate stand; (3) severe —plant competition prevents trees from restocking naturally.

Equipment limitations refer to soil characteristics that restrict or prohibit the use of equipment commonly used in tending and harvesting trees. Wetness is one of the dominant factors. The ratings are (1) slight—no restriction in the kind of equipment or in the time of year it is used; (2) moderate—seasonal restriction of less than 3 months in the use of equipment, and the equipment is likely to cause some damage to the roots of trees; (3) severe—seasonal restriction of more than 3 months in the use of equipment, and the equipment is likely to cause severe damage to the roots of trees.

Seedling mortality refers to the expected degree of mortality of naturally occurring or planted seedlings as influenced by kinds of soil. The ratings are (1) slight—less than 25 percent of the seedlings die, and ordinarily adequate natural regeneration will take place; (2) moderate—25 to 50 percent of the seedlings die, and natural regeneration is not always reliable for adequate and immediate restocking; (3) severe—more than 50 percent of the seedlings die, and much replanting, special seedbed preparation, and superior planting techniques are needed for adequate restocking.

Windthrow hazard is an evaluation of soil characteristics that control the development of tree roots and thus control the likelihood that trees will be uprooted by wind. The ratings are (1) slight—no special problem is recognized; (2) moderate—root development of certain kinds of trees is adequate for stability except during periods of excessive wetness and of greatest wind velocity; (3) severe–depth of tree roots does not give adequate stability.

Hazard of erosion refers to the hazard of soil loss when an area is managed according to currently acceptable standards. The ratings are (1) slight—no special management practices are needed to control erosion; (2) moderate—some preparation is needed to control erosion on roads, skid trails, and fire lanes; (3) severe—special management is needed to control erosion on roads, skid trails, and fire lanes.

Forest pest hazards are the expected damage or mortality of stands caused by such pests as Texas leafcutting ants, other insects, and gophers, as well as by fungi and wetness or dryness of certain soils. The ratings are (1) slight—little damage from pests is likely; (2) moderate—damage from pests is likely; some replanting or pest control may be necessary for full stocking; (3) severe—pest control is necessary before planting; complete replanting may be necessary if pests are not controlled.

Woodland suitability groups

The soils in Chambers County that are suitable for woodland have been placed in five woodland suitability groups. This grouping helps landowners plan the use of their soils for woodland. The soils in a particular group have about the same potential productivity, produce the same kinds of wood crops, and respond to similar management.

The woodland suitability group is identified by a three-part symbol; for example, 2w8. The first element of the group symbol indicates the woodland suitability class and expresses site quality. It is based on the average site index of one or more indicator forest types or tree species. Class 1 has the highest potential productivity, followed by classes 2, 3, 4, and 5. All classes are not in Chambers County.

The second element in the symbol indicates the suitability subclass and expresses soil properties that cause moderate to severe hazards or limitations in woodland use or management. The six subclasses recognized in the system are (1) subclass w—soils in which excessive water, either seasonally or year long, causes significant limitations for woodland use or management, (2) subclass c—soils that have restrictions or limitations for woodland use or management caused by the kind or amount of clay in the upper part of the soil profile, (3) subclass s—sandy soils that have moderate to severe restrictions or limitations for woodland use or management because they have little or no textural B horizons, (4) subclass f—soils that have restrictions or limitations for woodland use or management because large amounts of coarse fragments are in the profile, (5) subclass o—soils that have no significant restrictions or limitations for woodland use or management, and (6) subclass t—soils that have toxic substances in their rooting zone that limit or impede the development of desirable kinds of trees. All subclasses are not in Chambers County.

The third element in the symbol indicates the degree of hazards or limitations and the general suitability of the soils for certain kinds of trees. The three management problems considered are erosion hazard, equipment restrictions, and seedling mortality. The numbers used in the third element and their meaning are as follows: Number 1–indicates soils that have none to slight management limitations and are best suited to needleleaf trees. Number 2—indicates soils that have one or more moderate management limitations and are best suited to needleleaf trees. Number 3—indicates soils that have one or more severe management limitations and are best suited to needleleaf trees. Number 4—indicates soils that have none to slight management limitations and are best suited to broadleaf trees. Number 5—indicates soils that have one or more moderate management limitations and are best suited to broadleaf trees. Number 6—indicates soils that have one or more severe management limitations and are best suited to broadleaf trees. Number 7—indicates soils that have none to slight management limitations and are suitable for either needleleaf or broadleaf trees. Number 8—indicates soils that have one or more moderate management limitations and are suitable for either needleleaf or broadleaf trees. Number 9—indicates soils that have one or more severe management limitations and are suitable for either needleleaf or broadleaf trees. The number 0—indicates soils that are not suitable for the production of major commercial trees. All of these numbers are not in Chambers County.

To find the name of the soil in any woodland suitability group refer to the "Guide to Mapping Units" at the back of this survey.

WOODLAND SUITABILITY GROUP 1w6

Kaufman clay, frequently flooded, is the only soil in this group. Plant competition is severe on this soil.

It is difficult to establish the desired kinds of trees on this soil, because seedling mortality is high. Natural regeneration is not always reliable. Special site preparation, such as controlled burning, use of chemicals, deadening of undesirable trees and brush, and possibly underplanting, is needed in many places.

Equipment can be used only when this soil is dry. Equipment is difficult to maneuver and causes damage to tree roots and soil structure when this soil is wet.

The hazards of erosion and windthrow are slight. The soil in this group is suited to water-tolerant hardwoods, such as cypress, water oak, and sweetgum. Unless major reclamation is used to correct the water problems, this soil should be managed for these hardwood species. The site index for cypress is 96.

WOODLAND SUITABILITY GROUP 2w8

This group consists of loamy, clayey, nearly level or gently sloping soils. Plant competition is severe. Natural regeneration is not always reliable. Special site preparation, such as controlled burning, use of chemicals, deadening of undesirable trees and brush, and possibly underplanting, is needed in many places.

Equipment limitation is moderate. Equipment is difficult to maneuver and causes severe damage to tree roots and soil structure when these soils are wet.

Seedling mortality is moderate. As much as 25 to 50 percent of planted seedlings may die.

The hazards of erosion, windthrow, or soil-associated forest pests are slight.

The soils in this group are suited to either pine or hardwood trees. Preferred species are loblolly pine, slash pine, white oak, red oak, and sweetgum. The site index for loblolly pine and slash pine ranges from 86 to 95.

WOODLAND SUITABILITY GROUP 2w9

This group consists of loamy, nearly level or depressional soils. Plant competition is severe. Natural regeneration is not always reliable. Special site preparation, such as controlled burning, use of chemicals, deadening of undesirable trees and brush, and possibly underplanting, is needed in many places.

Equipment limitation is severe. Equipment is difficult to maneuver and causes severe damage to tree roots and soil structure when these soils are wet. Seedling mortality is severe because the soils are wet for long periods.

The hazard of windthrow is slight.

The soils in this group are suited to either pine or hardwood trees. Preferred species are loblolly pine, slash pine, white oak, red oak, and sweetgum. The site index for loblolly pine and slash pine ranges from 86 to 95.

WOODLAND SUITABILITY GROUP 2o7

McKamie fine sandy loam, wet variant, 1 to 5 percent slopes, is the only soil in this group.

Plant competition is severe but does not prevent the establishment of desirable species; however, it may delay natural regeneration of trees and retard their initial growth. Special seedbed preparation helps to obtain an adequate stand of desirable trees.

Equipment limitation and seedling mortality are slight. As much as 20 to 30 percent of the planted seedlings may die, particularly during dry periods. The hazards of windthrow and erosion are slight.

The soil in this group is suited to either pine or hardwood trees. Preferred species are loblolly pine, red oak, white oak, magnolia, and water oak. The site index for loblolly pine and slash pine ranges from 86 to 95.

WOODLAND SUITABILITY GROUP 2s2

The nearly level Stowell loamy fine sand is the only soil in this group.

Plant competition is severe but does not prevent the establishment of desirable species; however, it may delay natural regeneration of trees and retard their initial growth. Special seedbed preparation helps to obtain an adequate stand of desirable trees.

Equipment limitation is slight. Seedling mortality is moderate. Loss of 25 to 35 percent of planted seedlings is likely. Some replanting is needed in most places to fill in openings. The hazard of windthrow is slight and causes little or no loss of trees.

If adequate cover is maintained, erosion is not a hazard. Forest pests, such as leaf-cutting ants and gophers, are a hazard when pine seedlings are planted. Where these pests occur, control practices should be carried out before planting.

The soil in this group is best suited to pine trees. Preferred species are loblolly pine. The site index for loblolly and slash pine ranges from 86 to 95.

Woodland productivity

When the site index of a given soil is known, yields of wood expressed in terms of cubic feet, cords, or board feet can be determined, because the site index expresses the total height of dominant trees at a definite age. The dominant trees are the larger trees, whose crowns join the general level of the forest canopy and occasionally extend beyond it.

Table 3, which is based on published research data, shows how site index can be readily converted into total merchantable volume (*8*). By adjusting the values in table 3, yields from understocked stands can be estimated.

Woodland grazing groups

In addition to the production of wood products from the tree overstory, the soils in Chambers County are also capable of growing a valuable understory plant community composed of shrubs, grasslike plants, grasses, and forbs. These plants may be grazed by domestic livestock or wildlife without affecting forest values.

The soils that grow timber in Chambers County have been grouped into five woodland grazing groups. The grazing group is a distinctive kind of forest land that differs from other kinds of forest land in the potential to produce native plants suitable for grazing and wildlife uses.

The amount of forage produced in a woodland area depends upon the age of the trees and the density of the canopy. Four canopy classes are recognized in the groupings for this county. Under a dense canopy, from 56 to 70 percent of the ground is shaded at midday; under a medium canopy, 36 to 55 percent; under a sparse canopy, 21 to 35 percent; under an open canopy,

TABLE 3.—*Stand and yield information per acre for well-stocked, unmanaged, normally growing stands of loblolly pine*

Site index	Age of stand	Total merchantable volume			Average height of dominant trees	Average diameter at breast height	Basal area at breast height	Trees per acre
	Years	*Cubic feet*	*Cords*	*Board feet (Scribner)*	*Feet*	*Inches*	*Square feet*	*Number*
80	20	2,350	22	700	43	5.0	129	950
	30	4,000	38	6,500	59	7.4	147	510
	40	5,300	51	14,800	72	9.2	156	345
	50	6,150	60	21,700	80	10.7	162	255
90	20	2,850	27	1,000	48	5.6	133	790
	30	4,700	46	10,700	67	8.2	152	420
	40	6,200	61	20,550	81	10.2	162	290
	50	7,200	71	28,250	90	12.0	167	220
100	20	3,300	32	2,750	54	6.1	138	690
	30	5,400	53	14,800	74	9.0	158	375
	40	7,150	71	26,700	90	11.2	168	255
	50	8,400	84	35,050	100	13.1	174	190

0 to 20 percent. The potential yields of forage, by canopy classes, are shown in the descriptions of the grazing groups.

The information in the following descriptions of the five woodland groups in Chambers County relates mainly to the production of understory vegetation that can be used as forage. The kinds and amounts of understory vegetation depend on the nature of the soils and the density of the overstory. To find the woodland grazing group for any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

BLACKLAND GRAZING GROUP

This group is made up of deep, nearly level to gently sloping, clayey soils.

The main grazing plants for cattle are indiangrass, little bluestem, switchgrass, Florida paspalum, Virginia wildrye, big bluestem, and Texas bluegrass. Secondary grazing plants are silver bluestem, meadow dropseed, Texas wintergrass, longspike tridens, low-growing panicums, sedges, perennial legumes, brownseed paspalum, and carpetgrass. Plants that have low forage value are Texas grama, western grama, windmillgrass, common broomweed, snow-on-the-prairie, tumblegrass, annual grasses, and annual legumes.

Under a dense canopy, the annual yield per acre of air-dry herbage is 500 to 2,000 pounds; under a medium canopy, 1,000 to 4,000 pounds; under a sparse canopy, 1,500 to 6,000 pounds; and under an open canopy, 2,500 to 7,000 pounds.

CLAYEY BOTTOMLAND GRAZING GROUP

Kaufman clay, frequently flooded, is the only soil in this group. This deep, nearly level soil is on flood plains.

The main grazing plants for cattle are sedges, Virginia wildrye, beaked panicum, switchgrass, longleaf uniola, switchcane, and eastern gamagrass. Secondary grazing plants are redtop panicum, nimblewillgrass, two-flower melic, meadow dropseed, low-growing panicums, and low-growing paspalums. Plants that have low forage value are broomsedge bluestem, bushy bluestem, sumpweed, blood ragweed, annual grasses, and annual legumes.

Under a dense canopy, the annual yield per acre of air-dry herbage is 1,000 to 2,000 pounds; under a medium canopy, 1,000 to 4,000 pounds; under a sparse canopy, 2,000 to 8,000 pounds; and under an open canopy, 3,000 to 10,000 pounds.

FLATWOODS GRAZING GROUP

This group consists of deep, loamy, nearly level soils.

The main grazing plants for cattle are indiangrass, big bluestem, little bluestem, pinehill bluestem, beaked panicum, eastern gamagrass, silver plumgrass, brownseed paspalum, Florida paspalum, and longleaf uniola. Secondary grazing plants are sedges, low-growing panicums, Virginia wildrye, broadleaf uniola, longspike tridens, lespedeza, Carolina jointtail, redtop panicum, two-flower melic, and cutover muhly. Plants that have low forage value are carpetgrass, broomsedge bluestem, slim aster, bushy bluestem, palmetto, berry vines, waxmyrtle, poison-oak, blood ragweed, annual grasses, and annual legumes.

Under a dense canopy, the annual yield per acre of air-dry herbage is 500 to 3,000 pounds; under a medium canopy, 1,000 to 5,000 pounds; under a sparse canopy, 1,000 to 8,000 pounds; and under an open canopy, 2,000 to 9,000 pounds.

SANDY GRAZING GROUP

Stowell loamy fine sand is the only soil in this group. This deep sandy soil is nearly level.

The main grazing plants for cattle are little bluestem, indiangrass, slender indiangrass, purpletop, Florida paspalum, and big bluestem. Secondary grazing plants are longleaf uniola, low-growing panicums, fringeleaf paspalum, hairy dropseed, woolly sheath three-awn, brownseed paspalum, lespedeza, tickclover, and spiderwort. Plants that have low forage value are arrowfeather three-awn, red lovegrass, yankeeweed, beautyberry, yaupon, berry vines, poison-ivy, bullnettle, broomsedge bluestem, annual grasses, and annual weeds.

Under a dense canopy, the annual yield per acre of air-dry herbage is 500 to 2,000 pounds; under a medium canopy, 1,000 to 3,000 pounds; under a sparse canopy,

1,600 to 5,000 pounds; and under an open canopy, 2,000 to 6,000 pounds.

SANDY LOAM GRAZING GROUP

McKamie fine sandy loam, wet variant, 1 to 5 percent slopes, is the only soil in this group.

The main grazing plants for cattle are pinehill bluestem, little bluestem, beaked panicum, switchgrass, indiangrass, big bluestem, swamp sunflower, Florida paspalum, and purpletop. Secondary grazing plants are brownseed paspalum, pineywood dropseed, purple lovegrass, low-growing panicums, low-growing paspalums, sedges, longleaf uniola, fall witchgrass, mourning lovegrass, legumes, and forbs. Plants that have a low forage value are red lovegrass, slender bluestem, broomsedge bluestem, windmillgrass, yankeeweed, poison-ivy, snow-on-the-prairie, arrowfeather, three-awn, cutover muhly, carpetgrass, vasseygrass, annual weeds, and curlycup gumweed.

Under a dense canopy, the average yield per acre of air-dry herbage is 500 to 2,000 pounds; under a medium canopy, 1,000 to 4,000 pounds; under a sparse canopy, 1,500 to 5,000 pounds; and under an open canopy, 2,000 to 6,000 pounds.

Wildlife

The water areas and soils in Chambers County provide wintering grounds for several thousand birds and permanent habitats for many furbearing animals. Most waterfowl concentrate in the area from October through March.

Important kinds of wildlife in the county are duck, geese, quail, dove, raccoon, mink, squirrel, nutria, and muskrat. Other, less numerous kinds of wildlife are blackbird, meadowlark, deer, alligator, and prairie chicken. The county is a winter home for duck, geese, rail, coot, crane, and many other birds.

Fish, oysters, and shrimp are in the Trinity River and in the many freshwater, brackish, and saline lakes, ponds, canals, bayous, and bays. An important commercial and sport fishing industry is based on the harvest and sale of seafood, and in recent years a new industry of commercial catfish farming has developed in the county (fig. 14).

Soils that are suitable for timber, cultivation, pasture, and range can also be suitable for wildlife. Some soils can be managed for timber, crops, or range and for wildlife at the same time.

Successful management of wildlife on any tract of land requires that food, cover, and water be available in a suitable combination. A lack of any one of these necessities, an unfavorable balance between them, or an inadequate distribution of them may limit or account for the absence of a desired kind of wildlife (fig. 15).

Information on wildlife management can be obtained from employees of the Soil Conservation Service who give assistance to the Trinity Bay Soil and Water Conservation District, from the Texas Agricultural Extension Service, from the Texas Parks and Wildlife Department, and from the United States Fish and Wildlife Service.

Wildlife suitability

The suitability of soils in Chambers County for producing openland, woodland, and wetland wildlife is shown in table 4. The ratings are based on the limitations of the soil and include such soil properties as thickness of soil, texture of surface layer, available water capacity to a depth of 40 inches, wetness, salinity, flooding hazard, and slope. The ratings do not take into account the present use of the soil or the distribution of wildlife and human population. The following definitions are given for habitat suitability ratings used in table 4.

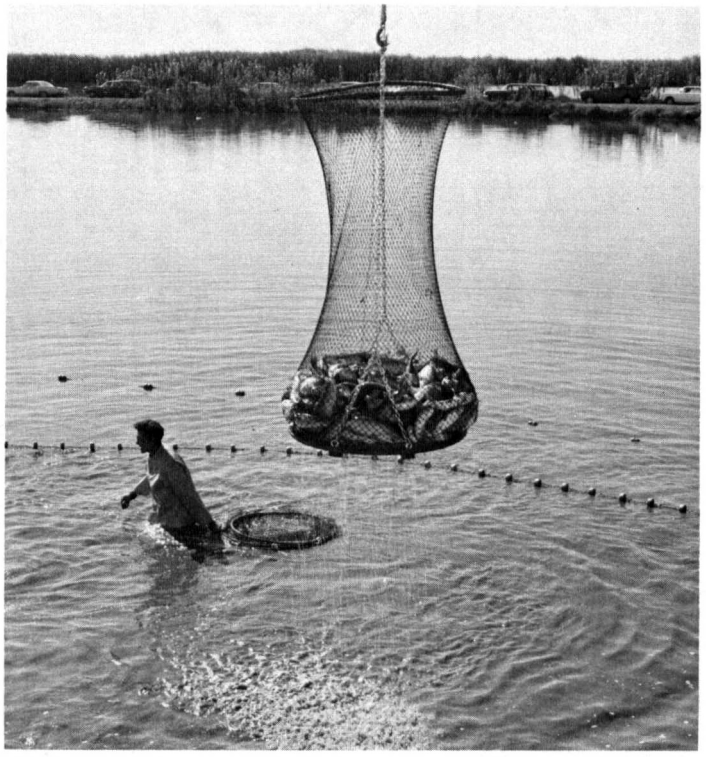

Figure 14.—Harvesting catfish from reservoir constructed on Beaumont clay.

Well suited indicates that habitats generally are easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected.

Suited indicates that habitats can be created, improved, or maintained in most places; that the soil has moderate limitations that affect management; and that moderate intensity of management and fairly frequent attention may be required for satisfactory results.

Poorly suited indicates that habitats can be created, improved, or maintained in most places; that the soil has rather severe limitations; that habitat management is difficult and requires intensive effort; and that results are not always satisfactory.

Unsuited indicates that the soil limitation is so severe that it is impractical to manage the designated habitat element. Unsatisfactory results are probable.

Seven elements of wildlife habitat are also rated for each soil in table 4. These seven elements are as follows:

Grain and seed crops are agricultural grains or seed-producing annuals that are planted to produce food for wildlife. Examples are corn, sorghum, millet, soybeans, and oats.

Grasses and legumes are domestic grasses and le-

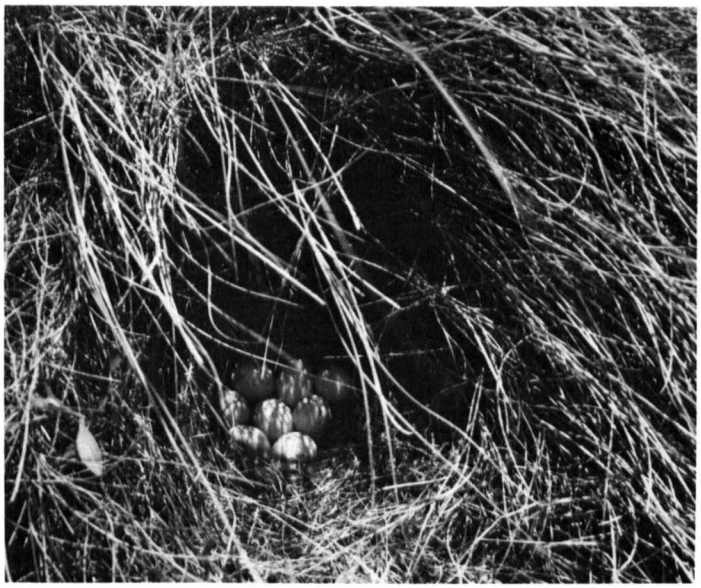

Figure 15.—**Protected vegetation on Stowell loamy fine sand provides nesting grounds for ducks.**

gumes that are established by planting and that furnish food and cover for wildlife. Examples are bahiagrass, ryegrass, fescue, clover, and lespedeza.

Wild herbaceous plants are perennial grasses, forbs, and weeds that provide food and cover for wildlife. Examples are beggarweed, croton, knotgrass, and spikesedge.

Hardwood trees and shrubs are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, or foliage that are used extensively as food by wildlife. In most places these trees and shrubs are native, but they can be planted. Examples are oak, cherry, dogwood, grape, honeysuckle, and greenbrier.

Coniferous woody plants are cone-bearing trees and shrubs that are used mainly as cover, but they can furnish food in the form of browse, seeds, or fruit-like cones. They become established through natural processes, or they can be planted. Examples are pines, junipers, and ornamentals.

Wetland food and cover plants are annual and perennial, wild herbaceous plants that grow on moist to wet sites. These plants furnish food and cover mostly for wetland wildlife. Examples are smartweed, wild millet, rushes, and sedges.

Shallow water developments are areas of low dikes and water-control structures established primarily to create habitat for waterfowl. They can be designed to be drained, planted, and flooded or to be used as permanent impoundments to grow submerged aquatics. Both freshwater and brackish water developments are included (fig. 16).

Figure 16.—**Water-control structure on Harris clay helps control water depth and salinity level.**

TABLE 4.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees and shrubs
Acadia: Ac	Suited	Suited	Well suited	Well suited
Anahuac: An	Suited	Suited	Well suited	Suited
Beaumont: Be	Poorly suited	Suited	Suited	Well suited
Calhoun: Ca	Poorly suited	Suited	Suited	Well suited
Clodine: Cd	Poorly suited	Poorly suited	Suited	Unsuited
Frost: Fo, FrB, Fs For Anahuac part of FrB, see Anahuac series. For Morey part of Fs, see Morey series.	Poorly suited	Suited	Suited	Well suited
Harris: Ha	Unsuited	Unsuited	Poorly suited	Unsuited
Ijam: Im	Unsuited	Unsuited	Poorly suited	Unsuited
Kaufman: Ka	Unsuited	Unsuited	Suited	Well suited
Lake Charles: LaA LaB	 Suited Suited	 Suited Suited	 Suited Well suited	 Well suited Well suited
McKamie: McB	Well suited	Well suited	Suited	Suited
Morey: Mo	Suited	Suited	Suited	Well suited
Psamments: PcB For Clodine part of PcB, see Clodine series.	Suited	Suited	Well suited	Poorly suited
Stowell: St, SwB For Clodine part of SwB, see Clodine series.	Suited	Suited	Well suited	Poorly suited
Vaiden: VaA VaB	 Poorly suited Poorly suited	 Poorly suited Poorly suited	 Suited Suited	 Well suited Well suited
Veston: Ve	Unsuited	Poorly suited	Poorly suited	Unsuited

The three general kinds of wildlife are defined as follows:

Openland wildlife consists of birds and mammals that normally frequent cultivated areas, pastures, and areas that are overgrown with grasses, herbs, and shrubs. Examples of this kind of wildlife are quail, rabbit, and meadowlark.

Woodland wildlife consists of birds and mammals that normally frequent wooded areas of hardwood trees and shrubs, coniferous trees and shrubs, or a mixture of these plants. Examples are deer, turkey, and squirrel.

Wetland wildlife consists of birds and mammals that normally frequent areas such as ponds, ditches, and marshes. Examples are duck, geese, rail, crane, mink, nutria, and muskrat.

Engineering Uses of the Soils [5]

This section is useful to those who need information about soils used either as structural material or as foundation material upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties most important in engineering are permeability, shear strength, compaction characteristics, drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope of the soil. These properties, in various degrees

[5] By O'GENE W. BARKEMEYER, civil engineer, Soil Conservation Service.

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued			Kinds of wildlife		
Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Openland	Woodland	Wetland
Well suited	Suited	Suited	Well suited	Well suited	Suited.
Well suited	Suited	Suited	Well suited	Suited	Suited.
Suited	Well suited	Well suited	Suited	Well suited	Well suited.
Suited	Well suited	Well suited	Suited	Well suited	Well suited.
Unsuited	Well suited	Well suited	Poorly suited	Unsuited	Well suited.
Suited	Well suited	Well suited	Suited	Well suited	Well suited.
Unsuited	Well suited	Well suited	Unsuited	Unsuited	Well suited.
Unsuited	Well suited	Well suited	Unsuited	Unsuited	Well suited.
Poorly suited	Suited	Poorly suited	Poorly suited	Suited	Suited.
Well suited	Well suited	Well suited	Suited	Well suited	Well suited.
Well suited	Poorly suited	Unsuited	Suited	Well suited	Poorly suited.
Well suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Suited	Well suited	Well suited	Suited	Well suited	Well suited.
Poorly suited	Suited	Suited	Suited	Poorly suited	Suited.
Well suited	Suited	Suited	Suited	Suited	Suited.
Well suited	Suited	Suited	Poorly suited	Well suited	Suited.
Well suited	Poorly suited	Unsuited	Poorly suited	Well suited	Poorly suited.
Poorly suited	Well suited	Well suited	Unsuited	Unsuited	Well suited.

and combinations, affect construction and maintenance of roads, airports, pipelines, small buildings, foundations, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate the performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5 and 6, which show, respectively, several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this table. The symbol < means

Soil series and map symbols	Seasonal high water table		Depth from surface	USDA texture	Classification	
	Depth from surface	Duration			Unified	AASHO
	Inches	*Months*	*Inches*			
Acadia: Ac	15–30	2–6	0–9	Silt loam	ML	A–4
			9–14	Silty clay loam	CL	A–6
			14–54	Clay	CH, CL	A–7
Anahuac: An	20–30	2–3	0–28	Silt loam	ML or ML–CL	A–4
			28–74	Silty clay and sandy clay loam.	CL or CH	A–7
Beaumont: Be	30–60	1–2	0–22	Clay	CH	A–7
			22–72	Clay	CH	A–7
Calhoun: Ca	0–15	2–6	0–16	Silt loam	ML–CL or ML	A–4
			16–60	Clay loam and clay.	CL	A–6
Clodine: Cd	0–20	3–6	0–72	Sandy clay loam	CL	A–6
*Frost: Fo, FrB, Fs	15–40	2–4	0–12	Silt loam	ML–CL	A–4 or A–6
For Anahuac part of FrB, see Anahuac series. For Morey part of Fs, see Morey series.			12–54	Silty clay loam	CL	A–7 or A–6
Harris: Ha	0–50	2–12	0–12	Clay	CH	A–7
			12–44	Clay	CH	A–7
			44–60	Silty clay	CH	A–7
Ijam: Im	0–24	3–12	0–62	Clay	CH	A–7
Kaufman: Ka	0–50	1–3	0–24	Clay	CH	A–7
			24–64	Clay	CH	A–7
Lake Charles: LaA, LaB	30–60	1–2	0–48	Clay	CH	A–7
			48–64	Clay	CH	A–7
McKamie: McB	>60		0–16	Fine sandy loam	SM or ML	A–4
			16–19	Sandy clay loam	CL	A–6
			19–44	Clay	CH	A–7
			44–70	Sandy clay loam	CL	A–6
Morey: Mo	30–60	1–2	0–12	Silt loam	CL or ML	A–4 or A–6
			12–52	Silty clay loam	CL	A–7, A–6
			52–64	Silty clay loam	CH, CL	A–7
*Psamments: PcB. Properties too variable to rate. For Clodine part of PcB, see Clodine series.						
*Stowell: St, SwB	20–40	3–5	0–42	Loamy fine sand	SM, SP	A–2–4
For Clodine part of SwB, see Clodine series.			42–47	Fine sandy loam	SM or ML	A–4
			47–78	Sandy clay loam	CL	A–6 or A–7
Vaiden: VaA, VaB	12–24	3–5	0–4	Clay	MH, CH	A–7
			4–60	Clay	CH	A–7
Veston: Ve	0–10	4–12	0–8	Silt loam	CL or ML	A–4 or A–6
			8–63	Silty clay loam	CH or CL	A–7

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the less than, and the symbol > means more than. Absence of data indicates that no estimate was made]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Inches per hour	*Inches per inch of soil*	*pH*		
100	100	95–100	85–100	0.20–0.63	0.21–0.23	4.5–6.0	None	Low.
100	100	95–100	85–100	0.20–0.63	0.20–0.21	4.5–5.5	None	Moderate.
100	100	95–100	90–100	<0.06	0.19–0.20	4.5–5.5	None	High.
95–100	90–100	85–99	65–95	0.63–2.00	0.12–0.13	5.1–6.5	None	Low.
---	---	95–100	70–90	<0.06	0.15–0.20	5.1–7.3	None	High.
100	98–100	85–100	80–95	0.06–0.20	0.15–0.20	5.1–5.5	None	High.
100	98–100	85–100	80–95	<0.06	0.15–0.20	5.1–8.4	Low	High.
100	100	100	85–95	0.20–0.63	0.22–0.23	4.5–6.0	None	Low.
100	100	100	85–95	0.06–0.20	0.21–0.22	4.5–5.5	None	Moderate.
100	90–100	85–95	60–80	0.06–0.20	0.05–0.12	6.6–8.4	Moderate	Moderate.
100	100	95–100	85–95	0.20–0.63	0.22–0.23	5.6–6.0	None	Low.
100	100	95–100	90–100	0.06–0.20	0.20–0.21	5.6–8.4	Low	Moderate.
---	80–95	70–95	70–95	0.06–0.20	0.02–0.20	5.1–9.0	Moderate	High.
---	90–100	90–100	80–90	<0.06	0.01–0.10	5.1–9.0	High	High.
---	---	90–100	85–95	<0.06	0.01–0.10	7.9–9.0	High	High.
---	90–95	85–95	80–95	<0.06	0.10–0.12	6.6–9.0	Moderate	High.
---	100	95–100	90–95	0.06–0.20	0.15–0.20	6.1–7.8	Low	High.
---	100	95–100	90–95	<0.06	0.15–0.20	6.6–8.4	None	High.
---	---	100	90–100	0.06–0.20	0.15–0.20	6.1–8.4	None	High.
95–100	90–100	80–95	75–95	<0.06	0.15–0.20	6.6–8.4	Low	High.
100	100	90–100	40–55	0.63–2.00	0.20–0.22	5.1–6.5	None	Low.
100	100	95–100	85–95	0.20–0.63	0.18–0.20	4.5–6.0	None	Moderate.
100	100	95–100	85–95	<0.06	0.18–0.20	4.5–6.0	None	High.
100	100	95–100	85–95	0.20–0.63	0.18–0.20	4.5–6.0	None	Moderate.
100	98–100	95–100	85–95	0.63–2.00	0.18–0.20	5.6–7.3	None	Low.
100	98–100	95–100	85–95	0.06–0.20	0.15–0.20	6.1–8.4	None	Moderate.
98–100	98–100	95–100	85–95	0.06–0.20	0.15–0.20	7.9–8.4	Moderate	High.
95–100	80–95	70–85	10–25	2.0–6.3	0.07–0.09	5.1–6.0	None	Low.
95–100	90–100	70–85	40–55	2.0–6.3	0.10–0.15	5.1–6.0	None	Low.
95–100	90–100	80–90	70–80	0.63–2.0	0.13–0.17	5.1–6.0	None	Low.
100	100	95–100	85–95	0.20–0.63	0.10–0.15	4.5–6.0	None	High.
100	98–100	95–100	85–95	<0.06	0.10–0.15	4.5–7.8	None	High.
---	100	85–95	60–75	0.63–2.00	0.05–0.15	7.9–9.0	Moderate to high	Moderate.
---	100	95–100	85–95	0.06–0.20	0.02–0.10	7.9–9.0	High	Moderate.

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—				
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Farm ponds: Reservoir areas
Acadia: Ac	Fair: 7 to 15 inches of silt loam; somewhat poorly drained.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: somewhat poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Slight	Slight
Anahuac: An	Fair: somewhat poorly drained.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: somewhat poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Slight	Slight
Beaumont: Be	Poor: clay surface layer; poorly drained.	Poor: poor traffic-supporting capacity; high shrink-swell potential; poorly drained.	Severe: poor traffic-supporting capacity; high shrink-swell potential; poorly drained.	Severe: poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Slight	Slight
Calhoun: Ca	Poor: poorly drained.	Poor: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: slow permeability.	Slight	Slight
Clodine: Cd	Poor: poorly drained.	Poor: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: slow permeability.	Slight	Slight
*Frost: Fo, FrB, Fs. For Anahuac part of FrB, see Anahuac series. For Morey part of Fs, see Morey series.	Poor: poorly drained.	Poor: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: slow permeability.	Slight	Slight

engineering properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the table. Absence of entry in a column indicates that properties were not rated]

Degree of limitations and soil features affecting—Continued					Soil features affecting—		Corrosivity to—	
Farm ponds—Continued	Recreation							
Embankments	Camp areas	Picnic areas	Playgrounds	Paths and trails	Irrigation	Drainage	Uncoated steel	Concrete
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Very slow permeability; somewhat poorly drained.	Very slow permeability; nearly level.	High: clay; somewhat poorly drained.	High: clay; very strongly acid.
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Very slow permeability; somewhat poorly drained.	Very slow permeability; nearly level.	High: resistivity.	Low.
Moderate: fair slope stability.	Severe: clay; poorly drained; very slow permeability.	Severe: clay; poorly drained.	Severe: clay; poorly drained; very slow permeability.	Severe: clay; poorly drained.	Very slow permeability; poorly drained.	Clay; very slow permeability; nearly level.	High: clay; poorly drained.	Moderate: clay; strongly acid.
Moderate: medium compressibility; poor to fair resistance to piping and erosion.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Slow permeability; poorly drained.	Slow permeability; nearly level to depressional.	High: clay; poorly drained.	High: clay; very strongly acid.
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Slow permeability; salinity; poorly drained.	Slow permeability; nearly level to depressional; near sea level.	High: sandy clay loam; poorly drained.	Moderate: salinity.
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Slow permeability; poorly drained.	Slow permeability; nearly level to depressional.	High: silty clay loam; poorly drained.	Moderate: silty clay loam; medium acid.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—				
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Farm ponds: Reservoir areas
Harris: Ha	Poor: clay surface layer; very poorly drained.	Poor: poor traffic-supporting capacity; high shrink-swell potential; very poorly drained.	Severe: poor traffic-supporting capacity; high shrink-swell potential; very poorly drained.	Severe: very poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Moderate where organic matter is 2 to 15 percent.	Slight
Ijam: Im	Poor: clay surface layer; very poorly drained.	Poor: poor traffic-supporting capacity; high shrink-swell potential; very poorly drained.	Severe: poor traffic-supporting capacity; high shrink-swell potential; very poorly drained.	Severe: very poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Moderate where organic matter is 2 to 10 percent.	Slight
Kaufman: Ka	Poor: clay surface layer.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential; flooding hazard.	Severe: somewhat poorly drained; high shrink-swell potential; flooding hazard.	Severe: very slow permeability; flooding hazard.	Slight	Slight
Lake Charles: LaA, LaB	Poor: clay surface layer.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: somewhat poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight
McKamie: McB	Fair: 12 to 16 inches of fine sandy loam.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight

properties of the soils—Continued

Degree of limitations and soil features affecting—Continued					Soil features affecting—		Corrosivity to—	
Farm ponds—Continued	Recreation							
Embankments	Camp areas	Picnic areas	Playgrounds	Paths and trails	Irrigation	Drainage	Uncoated steel	Concrete
Moderate: fair slope stability; high compressibility.	Severe: clay; very poorly drained; very slow permeability.	Severe: clay; very poorly drained.	Severe: clay; very poorly drained; very slow permeability.	Severe: clay; very poorly drained.	Salinity; very poorly drained.	Clay; very slow permeability; near sea level.	High: silty clay and clay; very poorly drained.	High: salinity.
Moderate: fair slope stability; high compressibility.	Severe: clay; very poorly drained; very slow permeability.	Severe: clay; very poorly drained.	Severe: clay; very poorly drained; very slow permeability.	Severe: clay; very poorly drained.	Salinity; very poorly drained.	Clay; very slow permeability; near sea level.	High: clay; very poorly drained.	High: salinity.
Moderate: fair slope stability; high compressibility.	Severe: clay; very poorly drained; very slow permeability; flooding hazard.	Severe: clay; flooding hazard.	Severe: clay; somewhat poorly drained; very slow permeability; flooding hazard.	Severe: clay.	Very slow permeability; flooding hazard.	Very slow permeability; flooding hazard; near sea level.	High: clay; very poorly drained.	Low.
Moderate: fair slope stability; high compressibility.	Severe: clay; somewhat poorly drained; very slow permeability.	Severe: clay.	Severe: clay; somewhat poorly drained; very slow permeability.	Severe: clay.	Very slow permeability; somewhat poorly drained.	Clay; very slow permeability; nearly level.	High: clay; somewhat poorly drained.	Low.
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: very slow permeability.	Slight ------	Severe: very slow permeability.	Slight ------	Very slow permeability.	Very slow permeability.	High: conductivity.	High: sandy clay loam; very strongly acid.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Degree of limitations and soil features affecting—				
	Topsoil	Road subgrade	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Farm ponds: Reservoir areas
Morey: Mo	Poor: poorly drained.	Poor: poor traffic-supporting capacity; poorly drained; high shrink-swell potential.	Severe: poor traffic-supporting capacity; poorly drained; high shrink-swell potential.	Severe: poorly drained.	Severe: slow permeability.	Slight	Slight
*Psamments: PcB. Properties too variable to rate. For Clodine part of PcB, see Clodine series.							
*Stowell: St, SwB. For Clodine part of SwB, see Clodine series.	Poor: loamy fine sand surface layer.	Fair: fair traffic-supporting capacity; somewhat poorly drained.	Moderate: fair traffic-supporting capacity; somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: water table at a depth of 24 inches.	Severe: moderately rapid permeability above water table.	Severe: moderately rapid permeability above water table.
Vaiden: VaA, VaB	Poor: clay surface layer.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: somewhat poorly drained; high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 5 percent.	Slight
Veston: Ve	Poor: poorly drained.	Poor: poor traffic-supporting capacity; poorly drained.	Severe: poor traffic-supporting capacity; poorly drained.	Severe: poorly drained.	Severe: slow permeability; water table at a depth of 0 to 10 inches.	Slight	Slight

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a depth greater than those shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists and may be unfamiliar to engineers. Many of the terms commonly used in soil science are defined in the Glossary at the back of this survey.

properties of the soils—Continued

Degree of limitations and soil features affecting—Continued					Soil features affecting—		Corrosivity to—	
Farm ponds—Continued	Recreation							
Embankments	Camp areas	Picnic areas	Playgrounds	Paths and trails	Irrigation	Drainage	Uncoated steel	Concrete
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Slow intake rate; slow permeability.	Slow permeability; nearly level.	High: silty clay loam; poorly drained.	Low.
Moderate: poor slope stability; medium to low compressibility; poor resistance to piping and erosion.	Severe: somewhat poorly drained.	Moderate: loamy fine sand; somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: loamy fine sand; somewhat poorly drained.	Loamy fine sand; moundy; low available water capacity.	Nearly level; moundy.	High: sandy clay loam; somewhat poorly drained.	Moderate: sandy clay loam at a depth of about 47 inches; strongly acid.
Moderate: fair slope stability; high compressibility.	Severe: clay; somewhat poorly drained; very slow permeability.	Severe: clay.	Severe: clay; somewhat poorly drained; very slow permeability.	Severe: clay.	Very slow permeability; somewhat poorly drained; nearly level.	Clay; very slow permeability; nearly level.	High: clay; somewhat poorly drained.	Moderate: clay; very strongly acid.
Moderate: medium compressibility; good to fair resistance to piping and erosion.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Salinity; water table at a depth of 0 to 10 inches.	Near sea level.	High: silty clay loam; poorly drained.	Moderate: salinity.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system, adopted by the American Association of State Highway Officials, and the Unified system, used by the Soil Conservation Service engineers, United States Department of Defense, and others.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils that have high bearing strength and are the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low

strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

In the Unified system (*11*), soils are classified according to particle-size distribution, plasticity index, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

Soil properties significant to engineering

Several estimated soil properties significant to engineering are given in table 5. These estimates are made for typical soil profiles, by layers that are sufficiently different when used for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties.

Hydrologic soil groups give the potential runoff from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long-duration storms that occur after the soils are wet and have had the opportunity to swell and without the protective effects of vegetation. The groups range from open sand, which has the lowest runoff potential (Group A), to heavy clay, which has the highest runoff potential (Group D). They are defined in the paragraphs that follow.

Group A consists of soils that have a high infiltration rate even when thoroughly wetted. These are chiefly deep, well-drained to excessively drained sand or gravel, or both. These soils have a high rate of water transmission and a low runoff potential.

Group B consists of soils that have a moderate infiltration rate when thoroughly wetted. These are chiefly moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission and a moderate runoff potential.

Group C consists of soils that have slow infiltration rates when thoroughly wetted. These consist chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission and a high runoff potential.

Group D consists of soils that have very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils that are underlain by nearly impervious material. These soils have a very slow rate of water transmission and a very high runoff potential.

A column for hydrologic groups was not included in Table 5, because all the soils of Chambers County are in Hydrologic group "D."

Depth to bedrock was not included, because bedrock is at a great depth in all the soils of the county.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

In the column headed "Depth from Surface," the depth, in inches, is given for the major distinctive layers of the soil profile.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Estimates of a percentage passing a sieve are given as a range in percentage of soil material passing sieves of four sizes. This information is useful in helping to determine suitability of the soil as a material for construction purposes.

Permeability, as used in table 5, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered. This rating should not be confused with coefficient "k" used by engineers.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil expressed as a pH value. The pH value and relative terms used to described soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected in soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

Engineering interpretations of the soils

Estimates of the suitability of the soils for various engineering uses are given in table 6. These estimates are based on the engineering properties of soils shown in table 5, on test data for soils in nearby or adjoining areas, and on the experience of engineers and soil scientists with the soils of Chambers County. In table 6, ratings are used to summarize the limitation or suitability of the soils for all listed purposes except for irrigation and for drainage of cultivated areas and pasture. For these particular uses, table 6 lists those soil features not to be overlooked in the planning, installation, and maintenance of these structures.

The ratings used to indicate soil limitations are slight, moderate, and severe. *Slight* means that soil properties generally are favorable for the rated use, or in other words, the limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties are so unfavorable for a particular use that overcoming the limitations is very difficult and costly and commonly is not practical for the rated use.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, that is used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such uses. Ordinarily, only the surface layer is removed for topsoil, but other layers also may be suitable.

Road subgrade or road fill is the soil material on which a subbase is laid and the pavement is built. Suitability ratings are based on the performance of the soil material as subgrade when excavated and compacted or when compacted and used in place. In general, sandy material containing adequate binder is the best.

Highway location is influenced by features of the undisturbed soil that affect both construction and maintenance of highways. The soil features, favorable as well as unfavorable, are the main ones that affect geographic location of highways.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence the soils capacity to support low buildings that have normal foundation loads. Specific values of bearing capacity are not assigned.

Septic tank filter fields are affected mainly by seepage loss, location of water table, and susceptibility of the soil to flooding. The degree of limitations and main reasons for assigning moderate or severe limitations are given.

Sewage lagoons are influenced chiefly by soil features such as seepage loss, location of water table, and slope. The degree of limitations and main reasons for assigning moderate or severe limitations are given.

Farm pond reservoir areas are affected mainly by seepage loss. Such soil features as permeability, depth to water table, and depth of material that would allow seepage also affect reservoir areas.

Farm pond embankments serve as dams. Soil features such as depth, permeability, stability, and shrink-swell potential as well as the underlying material are most important to the use of soils for constructing embankments.

Camp areas for overnight or weeklong camping need to be on soils that are hard enough not to require hard surfacing for parking but that have no hard layers to interfere with setting tent pegs. Load bearing strength of the natural soil as influenced by soil texture and soil moisture is a particularly important criterion in this rating. Flooding, dustiness or muddiness, slope, and stoniness are other criteria used in rating the soils for camp areas.

Picnic areas are defined as tree-shaded, park-type areas that have tables and cooking grills and are readily accessible by automobile. It is assumed that vehicular traffic will be confined to access roads. Flooding, slope, texture of the surface layer, and amount of coarse fragments on the surface are considered in making the evaluation.

Playgrounds are natural soil areas used intensively for playing such sports as baseball, football, volleyball, soccer, and similar organized games. Because playgrounds are subject to intensive foot traffic, these areas need to be nearly level, have good drainage, and have a firm surface that is free of rock outcrops and stones.

Paths and trails are defined as footpaths, hiking trails, or bridlepaths along which a person has the opportunity to enjoy the beauties of nature. In making the rating, it is assumed that only enough natural vegetation is removed to provide a pathway and few if any excavations or fills are along the pathway. Since a grass cover cannot be maintained in the pathway, muddiness or dustiness is the most important soil feature considered in the rating. Stony or gravelly surfaces, steep slopes, flooding, and design and maintenance of these trafficways to minimize erosion are other important soil features.

Irrigation is affected by slope, permeability, and thickness of the soil. Potential flooding hazards that might wash out irrigation borders and tabs are also an important consideration.

Drainage is affected by permeability, texture of surface layer, flooding, slope stability on ditchbanks, and the nearness to sea level. The extent of drainage depends in part on the use of the land. Larger amounts of water will need to be removed from industrial and residential areas than from agricultural land. Nearly all residential and industrial sites, regardless of soil permeability, will benefit from drainage. Row crops need more drainage than rice or pasture crops. Tile drains are suitable for use on permeable soils. Open field ditches are suitable where gravity flow is adequate. Pump-off systems are normally used where gravity flow will not provide adequate drainage or where outside water is a problem.

Corrosivity is determined by soil condition at a depth of 4 feet. The corrosion of uncoated steel pipe is affected by drainage, texture, acidity, resistivity, and conductivity. The corrosion of concrete is affected by texture and reaction as well as by the amount of sodium, magnesium sulphate, or sodium chloride in the soil (fig. 17).

Sand and gravel were not included because none of

Figure 17.—Treated pipelines on a Vaiden clay help to control corrosion.

the soils in the county are good sources of these materials.

Formation and Classification of the Soils

The major factors of soil formation and how they have affected the soils of Chambers County are discussed in this section. In addition, the current system for classifying soils is defined, and the soils of the county are classified according to this system.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of development have acted on the soil material.

Climate and living organisms, especially vegetation, are the active factors of soil formation. They act on the parent material that has accumulated and slowly change it into a natural body with genetically related horizons.

Relief modifies the effects of climate and vegetation, mainly by its influence on drainage and runoff. The parent material also affects the kind of profile that can be formed, and in extreme cases determines it almost entirely. Finally, time is needed to change the parent material into a soil. It may be much or little, but some time is always required for horizon differentiation. In most places a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of one unless conditions are specified for the other four. Many of the processes of soil formation are unknown. The five factors of soil formation as they relate to the soils of Chambers County are discussed in the following paragraphs.

Parent material.—Old alluvium and marine sediment laid down by ancient streams and the Gulf of Mexico are the main parent materials of most soils in this county. These materials consist primarily of clay and sandy clay mixed with some clay loam, silt, and sand. They

originated from a multitude of soils, rocks, and unconsolidated sediment that existed throughout the flood plains of the ancient streams. Recent clayey and silty alluvium is the parent material of the soils along the flood plains of the Trinity River.

The parent material of the soils in Chambers County has a wide range of texture because of its origin. Textural differences are accompanied by differences in chemical and mineral composition. Sandy sediment generally is higher in quartz than silty or clayey sediment, but it is lower in feldspars and ferromagnesian minerals. Sandy sediment is characteristically more siliceous and lower in bases.

The parent materials were segregated to some extent when they were deposited by the ancient streams and the Gulf. The segregation was probably accomplished in much the same way as when present deltas are formed. When a river floods its channel, water spreads out over the flood plain and the coarser sediment is dropped first. As the floodwater continues to spread, it moves more slowly and deposits finer sediment, such as silt. When the flooding is over and still water is left standing in the lower areas of the flood plains, the finer sediment, or clay, settles out. As the materials were deposited, the stream channels cut back and forth across much of their flood plain and sometimes cut out natural levees that were previously laid down. Sometimes sand was deposited on top of clay, or sometimes clay on top of sand. After the materials were deposited, they were probably modified to some extent by wind and water.

The parent materials of Acadia, Anahuac, and McKamie soils consist of remnants of old channels and their sandy levees. The silty sediment is the parent materials of nearly level Calhoun, Frost, and Morey soils. The clayey sediment on the lower part of the ancient flood plains is the parent material of Beaumont, Lake Charles, Vaiden, and, to some extent, Harris soils. Sandy marine deposits are the parent materials of Clodine, Stowell, and Veston soils. Harris and Kaufman soils formed in marine sediment and in more recent alluvium on the present flood plain of the Trinity River.

After the parent materials were deposited and reworked by wind and water, other processes formed the soils in Chambers County.

Climate.—The humid, subtropical climate of Chambers County has been a uniform factor in soil formation, but it has made only a slight impression on the soils.

Most regions that have a humid, temperate climate have strongly weathered, leached, acid soils that are low in fertility. The soils of this county, however, are geologically young, and time has not yet permitted strong weathering of the sediment in place. The parent materials have come mainly from sections of the country where weathering was not intense. Thus, the kinds of soil normally associated with a humid, temperate climate do not occur in this county.

Plant and animal life.—Although native vegetation has been the principal living influence in the process of soil formation in Chambers County, earthworms and other forms of life, in and on the soil, also have contributed. Among the changes caused by living organisms are gains in organic-matter and nitrogen content, gains or losses in nutrients, and changes in structure and porosity.

In this county the soils formed under several different types of vegetation. The differences in native vegetation are associated mainly with variations in drainage and salinity. Some swampy areas of the flood plains mapped with Kaufman soils were once covered with cypress trees and water-tolerant grasses and sedges. As a result, the soils have a high content of organic matter in the surface layer.

Kaufman and other soils of the flood plains are still forming, chiefly under oak and gum trees and grass vegetation. These soils are wet and are too frequently flooded for pine trees to be established, but they are not swampy. They are young soils that receive fresh deposits of soil material. For these reasons, vegetation has had very little effect on their formation.

Acadia, Calhoun, and Vaiden soils formed under stands of pine and mixed stands of pine and hardwood trees. In most places soils that formed under trees are low in bases, and they are acid to a greater depth than soils that formed under grass. The decaying forest litter causes the formation of organic acids. These acids hasten the leaching of bases and encourage eluviation, a process responsible for the formation of an A2 horizon.

The soils of the coastal prairie and the marsh area formed under thick stands of grass. These soils contain more organic matter and are darker to a greater depth than soils that formed under trees. They are not so acid and are not leached of bases to so great a depth as the forest soils. The soils of the coastal marsh, such as Harris soils, are darker in color and higher in organic-matter content than similar soils of the coastal prairie, such as Beaumont soils.

Man has had an important effect on the direction and rate of soil formation in Chambers County. He has drained and cultivated the soils. He has also introduced new kinds of plants, added fertilizer, built levees for flood and storm protection, and irrigated crops. The effect of these manipulations is not immediately evident as far as soil formation is concerned.

Relief.—Relief, or lay of the land, has influenced soil formation in Chambers County primarily through its effect upon drainage and runoff.

This county is mostly a flat, featureless plain that has very little dissection by streams. The highest elevation, 50 feet above sea level, is in the northwestern part of the county. From this point, the surface slopes very gradually to the south and southeast to the level of the Gulf of Mexico. Slopes are generally less than one-half percent. Steeper slopes are near salt domes, on banks leading to the flood plains of the Trinity River and Cedar Bayou, and along some of the old natural levees of ancient streams.

Most soils in the county drain slowly because of the flatness of the land surface. Water moves into the main stream channels with difficulty. It moves slowly or very slowly through the soils, and drainage problems are increased.

The origin and deposition of parent material are responsible for most of the relief in the county. Regardless of whether the transporting agent was saltwater, freshwater, or wind, the sandier materials were deposited on slightly elevated ridges throughout the county. In these areas the soils are well drained and are sandy enough to permit the leaching of excess lime and the

movement of some clay from the surface layer into lower layers by the downward percolation of rainwater.

The combination of silty parent material and slight relief helped form the Anahuac soils, which are acid and differ in the texture of their surface layer and lower layers. Beaumont, Lake Charles, and Vaiden soils formed in clayey sediment that was deposited on the lower parts of ancient flood plains. Because relief is nearly level and the clayey parent material is resistant to soil-forming processes, these soils formed under conditions of very slow runoff and slow to very slow internal drainage. They have no textural profiles; however, some free lime has been leached from the surface layer. This leaching has made the surface layer acid to neutral. Some differences among these soils probably result from the amount of calcium that was in the original parent material, the vegetation under which the soils formed, and the length of time that the soils have been in place.

The more silty parent material of Acadia and Morey soils was deposited between the sandy ridgetops and the clayey flats. The relief of these areas is only slightly higher than that of the clayey flats. The soils formed under conditions of slow or very slow runoff and internal drainage. Internal drainage was probably better in the past than it is now, because some clay has moved from the surface layer to lower horizons. Nearly all of the free lime has been leached from the Acadia soils, but only part has been leached from the Morey soils. The major differences in the two soils were probably caused by the vegetation under which they formed. The length of time that the two soils have been in place and the calcium content of the original parent material may have caused some differences.

Calhoun and Frost soils formed under conditions of very slow or ponded runoff and slow or very slow internal drainage. These soils are in shallow depressions throughout the county and probably formed in parent material similar to that of Acadia and Morey soils. Poor drainage and surplus water greatly influenced the more advanced profile development of these soils.

The soils in depressional areas formed in permanently wet positions, and aeration has been greatly reduced or prevented. These areas are better protected from fire and overgrazing and are thus higher in organic-matter content than soils that are not in depressional areas. Relief has some influence on the amount and effect of flooding in these areas. Minor differences in elevation also influence the accumulation and removal of harmful salts in soils of the coastal marsh.

Time.—Time is required for soil formation. Some soils, such as those that formed in alluvial sediment on flood plains, require a short time. Some require a long time. When other factors are equal, the age of soils is reflected in the distinctness of the horizons in the profile. The importance of time as a factor in soil formation always depends on its combination with the other factors.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in development of the current system should search the latest literature available (*7*, 10).

The current system of classification has six categories. Beginning with broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar origin are grouped. In table 7, the soil series of Chambers County are placed in the order, subgroup, and family categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic grouping of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates.

SUBORDER: Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes having the greatest genetic similarity. Suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP: Each suborder is separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The soil features used in separating soils into great group are the self-mulching properties of clay, the soil temperature, the major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), the dark-red and dark-brown colors associated with basic rocks, and the like.

SUBGROUP: Each great group is subdivided into subgroups, one representing the central, or typic, segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup	Order
Acadia	Fine, montmorillonitic, thermic	Aeric Ochraqualfs	Alfisols.
Anahuac	Fine, mixed, thermic	Udollic Albaqualfs	Alfisols.
Beaumont	Fine, montmorillonitic, thermic	Entic Pelluderts	Vertisols.
Calhoun variant	Fine-silty, mixed, thermic	Typic Glossaqualfs	Alfisols.
Clodine [1]	Fine-loamy, mixed, thermic	Typic Ochraqualfs	Alfisols.
Frost	Fine-silty, mixed, thermic	Typic Glossaqualfs	Alfisols.
Harris	Fine, montmorillonitic, noncalcareous, thermic	Typic Haplaquolls	Mollisols.
Ijam	Fine, montmorillonitic, nonacid, thermic	Vertic Fluvaquents	Entisols.
Kaufman	Fine, montmorillonitic, noncalcareous, thermic	Vertic Haplaquolls	Mollisols.
Lake Charles [2]	Fine, montmorillonitic, thermic	Typic Pelluderts	Vertisols.
McKamie variant	Fine, mixed, thermic	Aquic Hapludalfs	Alfisols.
Morey	Fine-silty, mixed, thermic	Typic Argiaquolls	Mollisols.
Stowell	Fine-loamy, mixed, thermic	Typic Argialbolls	Mollisols.
Vaiden	Very-fine, montmorillonitic, thermic	Aquentic Chromuderts	Vertisols.
Veston [3]	Fine-silty, mixed, nonacid, hyperthermic	Typic Fluvaquents	Entisols.

[1] Clodine soils in Chambers County are outside of the range of the Clodine series, because they have a surface layer of sandy clay loam and mottled colors of olive and gray. These differences do not alter use or management.

[2] Lake Charles soils in Chambers County in mapping unit LaB are taxadjuncts to the Lake Charles series, because chroma is greater than 1.5 at a depth of 36 inches. This difference does not alter use or management.

[3] Veston soils in Chambers County are taxadjuncts to the Veston series, because the mean annual temperature at a depth of 20 inches is slightly less than 72° F. This difference does not alter use or management.

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on that are used as family differentiae (see table 7).

SERIES: As explained in the section "How This Survey Was Made," the series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and arrangement in the profile.

General Nature of the County

Chambers County is a nearly level coastal plain bordering Trinity, Galveston, and East Bays. Elevation ranges from sea level to 50 feet. Oil production since 1916 has amounted to more than one-half million barrels. Nine-tenths of the farm income is from crops, principally rice.

Three types of transportation—rail, highway, and waterway—connect the county with the metropolitan centers of Houston and Galveston on the west and Beaumont, Orange, and Port Arthur on the east.

History and Settlement

The early inhabitants of Chambers County were Indian tribes of Karankawas, Guapites, and Coopanes. They hunted and fished in the lower Trinity River area.

This county was organized in 1858 from Liberty and Jefferson Counties and was named for General T. J. Chambers, Surveyor General of Texas under Mexico.

Anahuac, the present county seat, became a permanent settlement in 1821, when it was made a port of entry for American colonists. Anahuac serves as a commercial center for a large rice, cattle, oil, fishing, and hunting area. The town has a barge canal connecting it with the Houston ship channel.

Climate [6]

The climate of Chambers County is humid subtropical and is characterized by warm summers. The prevailing wind is south-southeasterly. The proximity of the Gulf of Mexico and the bays results in a predominantly marine climate. Periods of modified continental influence occur during the colder months, when cold fronts from the northwest reach the coast. Average temperatures and precipitation probabilities are given in table 8. The climate is less extreme than in areas located a greater distance from the coastline. Rainfall is abun-

[6] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, United States Department of Commerce.

TABLE 8.—*Temperature and precipitation data*

[Data from Anahuac, Texas, elevation 24 feet, mainly for the period 1938–67. The symbol < means less than, the symbol > means more than]

Month	Temperature				Precipitation									Average number of days with—		
					Average total	Probability of receiving—										
	Average daily maximum	Average monthly maximum	Average daily minimum	Average monthly minimum		0 or trace	0.50 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.10 inch or more	0.50 inch or more	1 inch or more
	°F	°F	°F	°F	*Inches*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*			
January	61.3	76.2	41.3	24.0	4.09	<1	99	95	80	60	40	28	10	5	3	1
February	64.6	77.1	44.6	29.0	3.89	<1	96	90	70	50	32	25	15	5	3	1
March	70.2	82.1	49.5	33.8	2.74	<1	92	80	60	40	30	20	14	3	1	1
April	77.0	85.4	58.8	43.0	3.99	<1	96	90	70	50	35	20	15	4	2	1
May	83.3	89.7	65.6	55.0	4.16	<1	91	81	65	50	40	30	15	4	2	1
June	88.9	94.4	71.8	64.0	4.48	<1	93	85	65	50	35	30	20	4	2	1
July	91.1	97.0	73.9	68.8	5.49	<1	96	90	80	65	55	45	35	5	2	1
August	91.2	96.5	73.1	67.1	5.19	<1	98	94	80	68	50	39	29	6	4	2
September	87.7	94.6	67.8	55.8	5.02	<1	96	90	73	62	50	40	31	5	2	1
October	81.4	89.9	57.8	43.7	3.60	3	89	89	58	40	29	20	10	4	2	1
November	71.0	82.8	48.5	32.9	4.25	<1	96	90	70	51	35	25	19	5	3	1
December	64.6	78.0	43.1	27.0	4.72	<1	>99	97	89	70	55	35	25	4	3	2
Year	77.7	87.0			51.55									54	29	14

dant, averaging 51.55 inches annually. The relative humidity is rather high, as would be expected in a coastal area. The average annual relative humidity is 85 percent at 6:00 a.m., 65 percent at noon, and 70 percent at 6:00 p.m., central standard time. The area receives 64 percent of the total possible sunshine annually.

Winter temperatures are mild, being moderated by the influence of the relatively warm Gulf. Nighttime minimums are 32° F or below about 17 percent of the time. Cloudiness and fog occur more frequently in winter than in other seasons.

During the summer, persistent offshore winds cause nights to be relatively cool. Daytime temperatures are not so high as in areas away from the coast, and heat waves seldom occur. Precipitation is mostly of the showery type, but excessive, short-period rains fall at times.

Spring and fall are pleasant transitional seasons. Because the temperature of the Gulf is cooler in spring than in fall, cloudy weather is more frequent in spring. Occasionally, tropical disturbances occur late in summer or early in fall. They occur most frequently in September, but rarely are they of hurricane intensity. When tropical storms occur, they often produce very heavy rains in the county.

Chambers County has a long growing season (freeze-free period) that averages 261 days. The average date of the last occurrence of 32° F in spring is March 5, and the first occurrence of 32° F in fall is November 21. The average annual rate of lake evaporation is 52 inches.

Water Supply

Canals, rivers, bayous, reservoirs, freshwater and brackish water lakes, and stock ponds make up a large part of the county.

Individual water areas range from 4 acres to more than 4,500 acres in size.

Water areas are used for water supply, drainage outlets, shipping facilities, fishing, wildlife, and recreation. These areas are not placed in capability units or in other soil groups.

Surface Geology[7]

Chambers County lies within the Coastal Plain of Texas. The geologic formations slope gently toward the Gulf. The soil associations shown on the "General Soil Map" at the back of this survey can be closely correlated with the pattern of geologic units as shown on the Houston Sheet (*4*).

For this discussion, the geologic formations in Chambers County are divided into three groups according to age: (1) Recent, (2) late Pleistocene or early Recent, and (3) Pleistocene.

The youngest soils in the county are those in the Harris-Kaufman and the Harris-Veston-Ijam associations. Recent, or Holocene, alluvial deposits of the Trinity River and the coastal marsh are the parent materials of these soils. The Trinity River deposits in the Harris-Kaufman association are essentially a series of successive, abandoned deltas that are abandoned and eroding on the east and are active and growing on the west[8] (*6*). Linear sandy areas that are included in Kaufman clay, frequently flooded, are natural levees

[7] By SAUL ARONOW, Department of Geology, Lamar State College of Technology, Beaumont, Texas.

[8] M. C. MCEWEN, Sedimentary Framework of the Trinity River Delta, Ph.D. thesis, Rice University, Houston, Texas, 1961. (Unpublished)

that were deposited along distributary channels of the deltas.

The coastal marsh deposits in the Harris-Veston-Ijam association are growing in size. New material is added by storm overwash, organic matter accumulation, stream deposition, and very slow mass wasting of higher areas to the north. The parent materials are thin in places. Sediment from the older, underlying Beaumont Formation was locally excavated and brought to the surface when the Intracoastal Canal was dug and dredged out over the years. These areas make up part of the Ijam soils. Some saline areas of the Beaumont Formation also are in this association.

The most recent formations in the county, the Trinity River delta complex and the coastal marsh, were probably deposited within the past 4,500 years, when the sea level reached its present position. The most recent delta of the Trinity River, which separates Lake Anahuac from Trinity Bay, has been dated by radiocarbon methods. It was formed within the past 1,000 years (*5*).

The Deweyville Formation of the late Pleistocene or early Recent is mapped on the Houston Sheet as several terrace levels in the area north and northwest of Lake Anahuac (*4*). This formation is the parent material of the Acadia, Vaiden, and Calhoun soils in the Vaiden-Acadia-Calhoun association and of the McKamie and Morey soils. Acadia, Calhoun, Morey, and Vaiden soils are also near the Deweyville terraces on the upland Beaumont Formation. McKamie soils are only on these terraces. Morey soils are on the lowest terraces, along Interstate 10 near Wallisville. Some Morey soils are clayey and formed in the same kind of material as their upland counterparts. Some formed in straths or on terraces cut into the older Beaumont Formation, rather than on local, younger surfaces of river deposits.

The age of the terrace material (Deweyville Formation) on the east side of the Trinity River has been dated by radiocarbon methods. It ranges from more than 30,000 (*3*) to about 12,000 years in age. This Deweyville Formation may span in age the beginning of downcutting, when glaciers began to melt and the sea level began to rise (about 25,000 to 18,000 years ago). Old meander patterns on the surface of Deweyville deposits are several times larger than those of the present river flood plain. This indicates that stream discharge was considerably greater in the past, probably because of high-rainfall climates and melting glaciers. The higher terraces in Chambers County may record the beginning of downcutting. Lower terraces and large meander scars, similar to those on the eastern edge of Lake Anahuac and Lake Charlotte, may record the continuation of this water movement, when the valley refilled as the glaciers melted and the sea level rose.

Most of the Beaumont Formation, which is Pleistocene in age, consists of river deposits. Embedded in this formation, however, are deposits of a barrier island-beach system. This partly buried, segmented system was first identified near Corpus Christi Bay and was named for Ingleside, Texas, by W. A. Price (*5*). The Ingleside System is the parent material of the sandy soils in the Stowell-Clodine association and of the Anahuac-Morey-Frost association. Clodine and Frost soils are in rounded depressions within sandy areas. These depressions are in part wind excavated or modified; in part segmented, interbeach-ridge depressions; and in part segmented "guts" made during hurricanes. All are features that can be seen on present-day barrier islands.

The Beaumont Formation developed in a manner similar to the large alluvial plains of the present-day Brazos and Rio Grande Rivers. The Ingleside System, now tilted so that it is lower in the Smith Point area and rises to the northeast, is analgous to the present, barrier island-beach system of the Texas coast.

Following the deposition of the Beaumont Formation, sea level fell, perhaps as much as 450 feet below its present level, when the continental ice sheets advanced in North America. Water was taken from the oceans and locked up in these glaciers. The Trinity River, like the rest of the Gulf Coast streams, deepened its channel, entrenched the Beaumont Formation, and flowed across the vacated continental shelf before entering the Gulf of Mexico. When sea level rose during the retreat and melting of glaciers, Trinity Bay and the wide, alluvial valley upstream were flooded. The bay and valley were remnants of the older, larger, and deeper valley. The Trinity River is now filling this valley, but it has not yet completely succeeded as have the Brazos and Rio Grande Rivers.

River deposits of the Beaumont Formation were made by the Pleistocene Trinity River (*2, 12*) as a successive, laterally migrating series of meander belts that terminated in deltas. The soils of the Anahuac-Morey-Frost association are on the slightly elevated meander belts that are old, stream-channel, levee, and point-bar deposits. Anahuac soils are mostly on old point bars. Frost soils are in the depressional, winding or curved areas of abandoned channels and oxbows. In places these depressions may be of lake origin.

Soils of the Beaumont-Morey-Lake Charles association are in broad, lower areas that were formerly backswamp and intermeander belt "lows." Much of the natural drainage and part of the manmade canal and ditch systems in Chambers County were influenced by these "lows"; for example, Spindletop Bayou and the East Fork of Double Bayou.

Radiocarbon dates on wood and shells from both parts of the Beaumont Formation are older than 40,000 years, which is beyond the range of accurate dating. The Beaumont Formation was deposited during an interglacial period, or during one of several periods in which the ice retreated and the sea level rose. This interglacial period has been identified as possibly mid-Wisconsin (*3*), or as the older interval between the Wisconsin and Illinoian glacial stages, called the Sangamon. It is estimated that this interglacial stage ended about 70,000 years ago.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.3 or higher) or so a high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizons above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has (1) distinctive characteristics caused by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray to light gray, with or without mottling, in the deeper parts of the profile.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body of the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structures. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or other interpretative group, read the introduction to the section it is in for general information about its management. Dashes in a column mean that the mapping unit was not placed in that particular grouping. Other information is given in tables as follows:

Acreage and extent, table 1, page 8.
Predicted yields, table 2, page 23.
Stand and yield information for loblolly pine, table 3, page 31.
Suitability for wildlife, table 4, page 34.
Engineering uses of the soils, tables 5 and 6, pages 36 through 43.

Map symbol	Mapping unit	Page	Capability unit		Range site		Pasture and hay group		Woodland suitability group		Woodland grazing group	
			Symbol	Page	Name	Page	Symbol	Page	Symbol	Page	Name	Page
Ac	Acadia silt loam------	8	IIIw-3	20	--------	--	8A	28	2w8	30	Flatwoods	31
An	Anahuac silt loam-----	9	IIIw-3	20	Sandy Prairie	26	8A	28	---	--	--------	--
Be	Beaumont clay---------	9	IIIw-1	20	Blackland	24	7A	27	2w8	30	Blackland	31
Ca	Calhoun silt loam, sandy variant-------	10	IIIw-2	20	--------	--	8E	28	2w9	30	Flatwoods	31
Cd	Clodine sandy clay loam----------	10	VIs-1	22	Salty Prairie	26	7G	28	---	--	--------	--
Fo	Frost silt loam-------	11	IIIw-2	20	Lowland	25	8E	28	2w9	30	Flatwoods	31
FrB	Frost-Anahuac complex, undulating----------	11	IIIw-2	20	--------	--	8E	28	---	--	--------	--
	Frost part--------	--	-----	--	Lowland	25	--	--	---	--	--------	--
	Anahuac part------	--	-----	--	Sandy Prairie	26	--	--	---	--	--------	--
Fs	Frost-Morey complex, levelled----------	11	IIIw-2	20	--------	--	8E	28	2w9	30	Flatwoods	31
	Frost part--------	--	-----	--	Lowland	25	--	--	---	--	--------	--
	Morey part--------	--	-----	--	Loamy Prairie	25	--	--	---	--	--------	--
Ha	Harris clay----------	12	VIIw-1	22	Salt Marsh	25	--	---	---	--	--------	--
Im	Ijam soils----------	13	VIIw-2	22	Salty Prairie	26	--	---	---	--	--------	--
Ka	Kaufman clay, frequently flooded--	13	Vw-1	22	Bottomland	24	1A	27	1w6	29	Clayey Bottomland	31
LaA	Lake Charles clay, 0 to 1 percent slopes-	14	IIw-1	20	Blackland	24	7A	27	2w8	30	Blackland	31
LaB	Lake Charles clay, 1 to 5 percent slopes-	14	IIIe-1	20	Blackland	24	7A	27	2w8	30	Blackland	31
McB	McKamie fine sandy loam, wet variant, 1 to 5 percent slopes----------	15	IVe-1	21	--------	--	8C	28	2o7	30	Sandy Loam	32
Mo	Morey silt loam, levelled----------	15	IIIw-3	20	Loamy Prairie	25	7C	28	2w8	30	Flatwoods	31
PcB	Psamments-Clodine complex, undulating-	16	VIs-1	22	--------	--	7G	28	---	--	--------	--
	Psamments part----	--	-----	--	Coastal Sand	24	--	--	---	--	--------	--
	Clodine part------	--	-----	--	Salt Marsh	25	--	--	---	--	--------	--
St	Stowell loamy fine sand----------	17	IIIw-4	21	Coastal Sand	24	9C	28	2s2	30	Sandy	31
SwB	Stowell-Clodine complex, undulating-	17	VIs-1	22	--------	--	9C	28	---	--	--------	--
	Stowell part------	--	-----	--	Coastal Sand	24	--	--	---	--	--------	--
	Clodine part------	--	-----	--	Salt Marsh	25	--	--	---	--	--------	--
VaA	Vaiden clay, 0 to 1 percent slopes------	18	IIIw-1	20	Blackland	24	7A	27	2w8	30	Blackland	31
VaB	Vaiden clay, 1 to 5 percent slopes------	18	IIIe-1	20	Blackland	24	7A	27	2w8	30	Blackland	31
Ve	Veston soils----------	18	VIIw-2	22	Salty Prairie	26	--	--	---	--	--------	--

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SOIL ASSOCIATIONS

1 Beaumont-Morey-Lake Charles association: Acid to neutral, clayey and loamy soils.

2 Harris-Veston-Ijam association: Alkaline and saline, clayey and loamy soils.

3 Anahuac-Morey-Frost association: Acid loamy soils.

4 Vaiden-Acadia-Calhoun association: Acid, clayey and loamy soils.

5 Harris-Kafman association: Neutral and alkaline, saline and nonsaline, frequently flooded clayey soils.

6 Stowell-Clodine association: Acid and alkaline, sandy and loamy soils.

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

94°50′ 94°40′ 94°30′ 95°00′ 29°50′ 29°40′ 29°30′

LIBERTY COUNTY

JEFFERSON COUNTY

HARRIS COUNTY

GALVESTON COUNTY

ATKINSON ISLAND

WALLISVILLE RESERVOIR

LAKE ANAHUAC

TRINITY BAY

GALVESTON BAY

EAST BAY

Winifree · Mount Belvieu · Hankamer · Anahuac · Monroe City · Winnie · Stowell · Smith Point

Cedar Bayou · Cotton Bayou · Wet Marsh Pond · Cotton Lake · Old River Lake · Lost Lake · Lake Charlotte · Lake Miller · Turtle Bayou · Spring Bayou · Double Bayou · Oyster Bayou · Elm Bayou · Spindletop Bayou · Mud Bayou · Robinson Lake · Lake Stephenson · Lake Surprise · Wallis Lake

Hill Canal · Barbers Canal · Hankamer Stowell Canal · Oodex Canal · Devers Ditch · Lone Star Canal · Atchison Topeka and Santa Fe · Gulf Intracoastal Waterway

Standlind Reservoir · Reservoir No. 4 · Reservoir No. 2

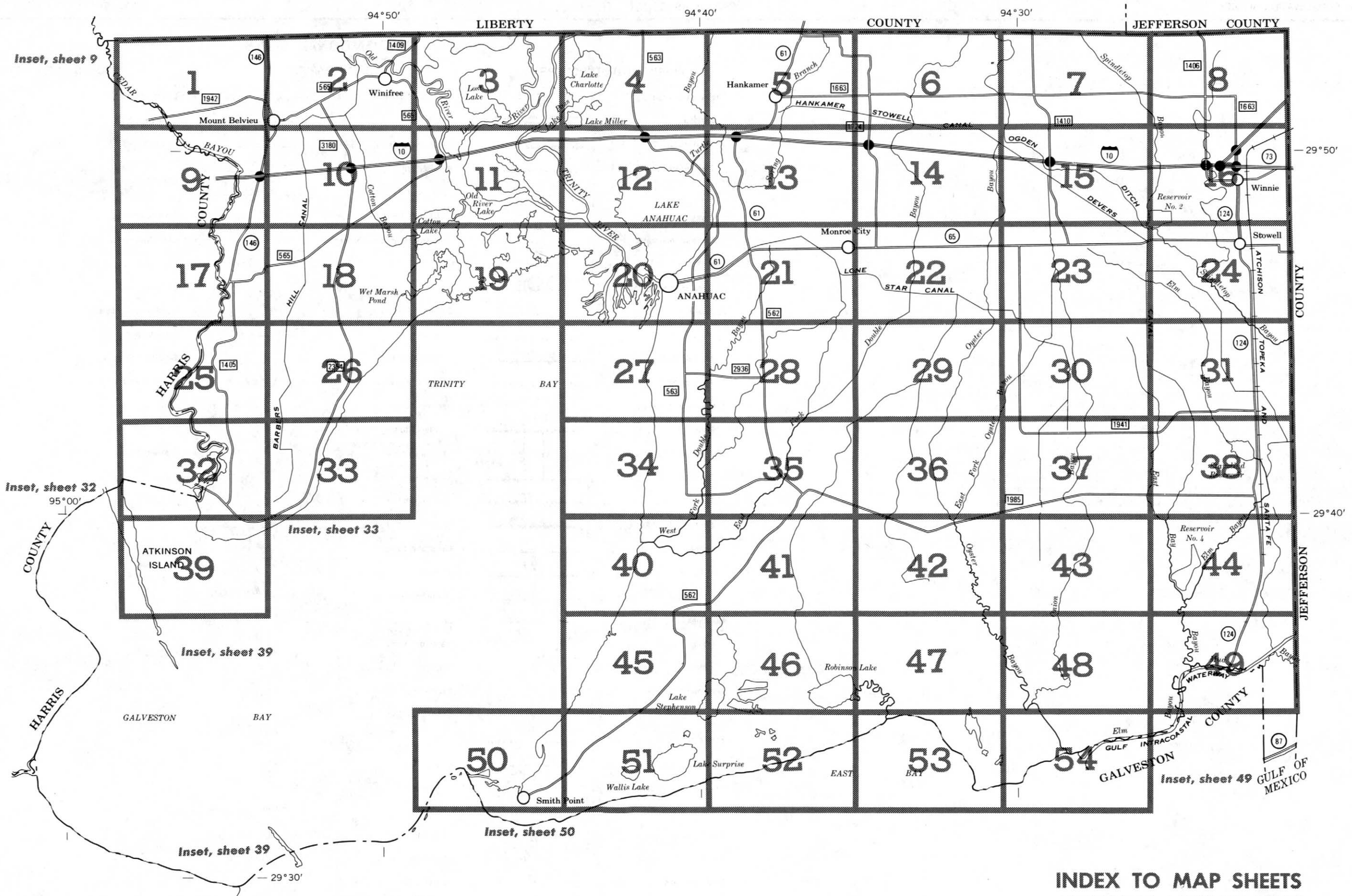
U. S. DEPARTMENT OF AGRICULTURE

GENERAL SOIL MAP

CHAMBERS COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS
CHAMBERS COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A or B, indicates the class of slope. Symbols without a slope letter are those of nearly level soils.

SYMBOL	NAME
Ac	Acadia silt loam
An	Anahuac silt loam
Be	Beaumont clay
Ca	Calhoun silt loam, sandy variant
Cd	Clodine sandy clay loam
Fo	Frost silt loam
FrB	Frost-Anahuac complex, undulating
Fs	Frost-Morey complex, levelled
Ha	Harris clay
Im	Ijam soils
Ka	Kaufman clay, frequently flooded
LaA	Lake Charles clay, 0 to 1 percent slopes
LaB	Lake Charles clay, 1 to 5 percent slopes
McB	McKamie fine sandy loam, wet variant, 1 to 5 percent slopes
Mo	Morey silt loam, levelled
PcB	Psamments-Clodine complex, undulating
St	Stowell loamy fine sand
SwB	Stowell-Clodine complex, undulating
VaA	Vaiden clay, 0 to 1 percent slopes
VaB	Vaiden clay, 1 to 5 percent slopes
Ve	Veston soils

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

- Highways and roads
  - Divided
  - Good motor
  - Poor motor
  - Trail
- Highway markers
  - National Interstate
  - U. S.
  - State, farm or ranch
- Railroads
  - Single track
  - Multiple track
  - Abandoned
- Bridges and crossings
  - Road
  - Trail
  - Railroad
  - Ferry (FY)
  - Ford (FORD)
  - Grade
  - R. R. over
  - R. R. under
- Buildings
  - School
  - Church
- Mine and quarry
- Gravel pit
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Forest fire or lookout station
- Windmill
- Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

- Streams, double-line
  - Perennial
  - Intermittent
- Streams, single-line
  - Perennial
  - Intermittent
    - Crossable with tillage implements
    - Not crossable with tillage implements
    - Unclassified
- Canals and ditches
- Lakes and ponds
  - Perennial (water, w)
  - Intermittent (int)
- Spring
- Marsh or swamp
- Wet spot
- Proposed pool line
- Directional flow

RELIEF

- Escarpments
  - Bedrock
  - Other
- Short steep slope
- Prominent peak
- Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Borrow pit (B.P.)
- Oil wasteland (O.W.)

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 1

3 280 000 FEET

770 000 FEET

LIBERTY COUNTY

Reservoir

Gully

LaA

Be

Fs

Mo

Fo

FrB

w

146

1942

1409

CANAL

Rhekory Island

SOUTHERN PACIFIC

HILL

BARBERS

Reservoir

Gully

CEDAR

HARRIS COUNTY

BAYOU

OIL WASTE

An

MONT BELVIEU

Barbers Hill

(Joins inset, sheet 9)

(Joins sheet 2)

(Joins sheet 9)

3 330 000 FEET

755 000 FEET

1

N

1 Mile

5000 Feet

Scale · 1:20000

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Coordinate grid ticks and land division corners, if shown, are approximately revisioned.

CHAMBERS COUNTY, TEXAS NO. 1

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 2

(2)

N

3 325 000 FEET

770 000 FEET

LIBERTY COUNTY

Little Canery Creek

1409

OLD RIVER

Cherry Point Gully

PROPOSED POOL LINE

WALLISVILLE RESERVOIR

Winifree

BARBERS HILL CANAL

Reservoir

OIL WASTE

MONT BELVIEU

146 207 565 3180

Fs Mo LaA VaA VaB McB An Fo Be

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 10)

755 000 FEET

3 305 000 FEET

CHAMBERS COUNTY, TEXAS NO. 2

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CHAMBERS COUNTY, TEXAS — SHEET NUMBER 3

3 330 000 FEET

770 000 FEET

LIBERTY COUNTY

WALLISVILLE RESERVOIR

PROPOSED POOL LINE

VaA VaB Be Mo

1409 565

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 11)

760 000 FEET

3 350 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000

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CHAMBERS COUNTY, TEXAS NO. 3

4

N

1 Mile
5000 Feet

Scale · 1:20000

3 370 000 FEET

7/0 000 FEET

LIBERTY COUNTY

563

Reservoir

B.P.

McB

Ac

Ka

VaA

Be

PROPOSED POOL LINE

Bayou

Cow Is Bayou

Turtle

Ca

WALLISVILLE RESERVOIR

Wallisville School

(Joins sheet 3)

760 000 FEET

(Joins sheet 5)

(Joins sheet 12)

3 355 000 FEET

TEXAS NO. 4

CHAMBERS COUNTY, TEXAS

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 5

3 375 000 FEET

770 000 FEET

LIBERTY COUNTY

(Joins sheet 4)

Turtle Bayou
Bayou
Island
Cow
Gully
Spring
Branch
Lee
Ca
VaA
VaB
Ac
An
Be
Mo
Fo
FrB
Hankamer
1663
61
CROOKED MARSH
Reservoir
BAYOU
CANAL
DITCH
HANKAMER
STOWELL
Whites Bayou
TURTLE BAYOU

760 000 FEET

3 395 000 FEET

(Joins sheet 13)

(Joins sheet 6)

5

N

1 Mile
5000 Feet

Scale 1:20000

1 0 1 2 3 4 5 000

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 6

6

N

1 Mile
5000 Feet
0
0
Scale 1:20000
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

3 420 000 FEET

775 000 FEET

760 000 FEET

3 400 000 FEET

LIBERTY COUNTY

Reservoir

CROOKED MARSH

Bayou

Double Fork

East Fork

CANAL

DEVERS WEST BRANCH

OGDEN DITCH

DITCH

HANKAMER STOWELL CANAL

1663

1724

An Be FrB Fo LaA Mo

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 14)

CHAMBERS COUNTY, TEXAS NO. 6

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CHAMBERS COUNTY, TEXAS — SHEET NUMBER 7

3 425 000 FEET

775 000 FEET

LIBERTY COUNTY

JEFFERSON COUNTY

OGDEN DITCH

CANAL

DEVERS CANAL

EAST BRANCH OGDEN DITCH

SPINDLETOP CANAL

BAYOU CANAL

Reservoir

1410

1663

An Be Fo Mo

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 15)

1760 000 FEET

3 445 000 FEET

7

N

1 Mile

5000 Feet

0 0

1 5000

¼ 1000

½ 2000

¾ 3000

1 4000

Scale 1:20000

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CHAMBERS COUNTY, TEXAS NO. 7

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 8

8

N

3 470 000 FEET

775 000 FEET

JEFFERSON COUNTY

(Joins sheet 7)

760 000 FEET

3 450 000 FEET (Joins sheet 10)

CANAL

1406 1663 1408

10

B.P

Mo An Be Fo FrB w

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

CHAMBERS COUNTY, TEXAS NO. 8

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CHAMBERS COUNTY, TEXAS NO. 9

3 280 000 FEET

750 000 FEET

765 000 FEET

760 000 FEET

3 272 000 FEET

3 275 000 FEET

3 000 AND 5 000-FOOT GRID TICKS

(Joins sheet 1)

(Joins sheet 10)

(Joins sheet 17)

3 300 000 FEET

740 000 FEET

LIBERTY COUNTY

CHAMBERS COUNTY

CEDAR BAYOU

HARRIS

SOUTHERN PACIFIC

OIL WASTE

MONT BELVIEU

Reservoir

Smith

Gully

Be

LaA

Mo

VaB

Fs

An

146

10

9

N

1 Mile

5000 Feet

Scale 1:20000

0

5000

¼

1 000

½

2 000

¾

3 000

4 000

10

N

1 Mile
5000 Feet
0
0
Scale 1:20000
¼
1 000
½
2 000
¾
3 000
1
4 000

(Joins sheet 2)

3 325 000 FEET

755 000 FEET

(Joins sheet 9)

740 000 FEET

3 305 000 FEET

(Joins sheet 18)

(Joins sheet 11)

MONT BELVIEU

OIL WASTE

CANAL

Barbers Hill High School

BARBERS HILL

Gully

Smith

Reservoir

Reservoir

Reservoir

Hackberry

Gully

COTTON BAYOU

207

3180

10

565

An

Be

LaA

Mo

Fs

VaB

w

CHAMBERS COUNTY, TEXAS NO. 10

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CHAMBERS COUNTY, TEXAS — SHEET NUMBER 11

3 330 000 FEET

(Joins sheet 3)

755 000 FEET

11

N

WALLISVILLE RESERVOIR

POOL LINE PROPOSED

COTTON BAYOU

Lawrence Lakes

COTTON LAKE

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 19)

745 000 FEET

3 350 000 FEET

1 Mile 5000 Feet

Scale 1:20000

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CHAMBERS COUNTY, TEXAS NO. 11

N

(Joins sheet 4)

3 375 000 FEET

WALLISVILLE RESERVOIR POOL LINE PROPOSED

Ac, Ca, Ha, Ka, McB, Mo, VaA, VaB

w

563

10

Eminence

Bayou Turtle

755 000 FEET

(Joins sheet 11)

745 000 FEET

Little Hog Bayou

HOG BAYOU

BIG THICKET LINE

TRINITY RIVER

WALLISVILLE RESERVOIR PROPOSED DAM

water

Smith Bayou

LAKE ANAHUAC

(Joins sheet 20)

3 355 000 FEET

(Joins sheet 13)

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

CHAMBERS COUNTY, TEXAS NO. 12

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CHAMBERS COUNTY, TEXAS NO. 13

3 380 000 FEET

755 000 FEET

(Joins sheet 5)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 21)

3 400 000 FEET

745 000 FEET

13

N

1 Mile

5000 Feet

Scale 1:20000

Ca VaA VaB Ac Be Fs FrB Fo An Mo LaA w

Reservoir

BAYOU TURTLE Branch Spring

Whites Bayou

BARROW SLOUGH

CANAL

LAKE ANAHUAC

10 61 563 2041

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 14

14

N

(Joins sheet 6)

3 420 000 FEET

HANKAMER

STOWELL CANAL

WEST BRANCH

DEVERS CANAL

OGDEN DITCH

Jenkins Reservoir

Reservoir

Double Fork Bayou

Bayou

Oyster Bayou

CANAL

755 000 FEET

745 000 FEET

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 22)

3 405 000 FEET

1724

10

Scale 1:20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

CHAMBERS COUNTY, TEXAS NO. 14

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CHAMBERS COUNTY, TEXAS NO. 15

3 425 000 FEET

755 000 FEET

(Joins sheet 14)

(Joins sheet 7)

(Joins sheet 16)

(Joins sheet 23)

3 445 000 FEET

745 000 FEET

15

N

1 Mile

5000 Feet

Scale 1:20000

EAST BRANCH DEVERS CANAL

CANAL

Reservoir

DEVERS EAST CANAL

OGDEN

Reservoir

SPINDLETOP DITCH

Reservoir

Oyster Bayou

DEVERS CANAL

Elm Bayou

BAYOU

Reservoir

1410

10

Be

An

Mo

Fo

Fs

FrB

3e

16

N

(Joins sheet 8)

3 470 000 FEET

760 000 FEET

(Joins sheet 15)

1 Mile
5000 Feet
0
0
Scale 1:20000
¼
1000
½
2000
¾
3000
1
4000
5000

745 000 FEET

3 450 000 FEET

(Joins sheet 24)

Be
Mo
An
Fo
FrB
w
Reservoir
CANAL
SANTA FE
TOPEKA
ATCHISON
AND
WINNIE
JEFFERSON COUNTY
1406
1663
1663
10
73
124

CHAMBERS COUNTY, TEXAS NO. 16

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CHAMBERS COUNTY, TEXAS — SHEET NUMBER 17

17

N

1 Mile
5000 Feet

Scale 1:20000

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CHAMBERS COUNTY, TEXAS NO. 17

18

N

(Joins sheet 10)

3 325 000 FEET

735 000 FEET

725 000 FEET

3 305 000 FEET

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 26)

Horsepen Bayou

Blackberry Gully

COTTON BAYOU

COTTON LAKE

Saw Pit Gully

BARBERS HILL CANAL

Reservoir

OIL WASTE

WET MARSH POND

Alligator Bayou

water

Mo

Fs

LaA

LaB

VaB

Ha

Be

Ac

Ve

w

2854

3180

565

2354

1 Mile

5000 Feet

0

Scale · 1:20000

1/4 1/2 3/4 1

1000 2000 3000 4000 5000

CHAMBERS COUNTY, TEXAS NO. 18

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CHAMBERS COUNTY, TEXAS NO. 19

3 330 000 FEET

735 000 FEET

(Joins sheet 11)

(Joins sheet 18)

(Joins sheet 20)

725 000 FEET

3 350 000 FEET

19

N

1 Mile

5000 Feet

Scale · 1:20000

COTTON LAKE

Reservoir

PROPOSED DAM

Lawrence Lakes

LONG ISLAND BAYOU

Horse Bayou

Mesquite Pond

Cane Pond

Pocket Bayou

THE RIDGE

Cove Bayou

Cove Island

Dunn Lake

water

Alligator Bayou

High Tree Bayou

CROSS BAYOU

DUNN BAYOU

Red Bayou

Double Bayou

WET MARSH POND

TRINITY BAY

Ha

VaB

Ve

Ka

20

N

Scale 1:20000

1 Mile 5000 Feet

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

3 375 000 FEET

740 000 FEET

725 000 FEET

(Joins sheet 12)

(Joins sheet 19)

(Joins sheet 27)

3 355 000 FEET

(Joins sheet 21)

PROPOSED DAM

TRINITY RIVER

LAKE ANAHUAC

TRINITY BAY

Garden Bayou

LONG ISLAND BAYOU

Jacks Pocket Pass

Jacks Bayou

Blind Pass

Pass

Big Triangle Pass

Little Triangle Pass

Southwest Pass

Bulkhead Cove

Old River

River Pass

Kings Pass

Browns Pass

ANAHUAC CHANNEL

LONE STAR CANAL

CANAL

ANAHUAC (county seat)

Courthouse

High School

ANAHUAC CEMETERY

CHAMBERS COUNTY AIRFIELD

Fort Anahuac Park

Ha

VaA

Be

Mo

Ca

water

563

61

CHAMBERS COUNTY, TEXAS NO. 20

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 21

21

N

3 380 000 FEET

740 000 FEET

730 000 FEET

3 400 000 FEET

(Joins sheet 13)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 28)

LAKE ANAHUAC

BARROW

SLOUGH

CANAL

LONE STAR CANAL

Monroe City

CHAMBERS COUNTY AIRFIELD

Double Bayou

West Fork

B.P.

Be

Mo

An

FrB

VaA

Fs

LaA

563

562

61

65

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 21

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 22

22

N

Scale · 1:20000

1 Mile 5000 Feet

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

(Joins sheet 14)

(Joins sheet 21)

(Joins sheet 29)

(Joins sheet 23)

3 425 000 FEET

740 000 FEET

730 000 FEET

3 405 000 FEET

1724

65

Mo LaA An FrB Be w

Bayou

Reservoir

Double

East Fork

Oyster

LONE STAR CANAL

CHAMBERS COUNTY, TEXAS NO. 22

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CHAMBERS COUNTY, TEXAS NO. 23

3 425 000 FEET

740 000 FEET

730 000 FEET

3 450 000 FEET

(Joins sheet 15)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 30)

23

N

1 Mile

5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Be Mo An Fo Fs FrB B.P

DEVERS EAST CANAL

OGDEN DITCH

Reservoir

SPINDLETOP BAYOU

Elm Bayou

DEVERS CANAL

Onion Bayou

CANAL

East Fork Oyster Bayou

MAIN CANAL

LONE STAR CANAL

1941

65

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 24

24

N

(Joins sheet 16)

3 470 000 FEET

740 000 FEET

730 000 FEET

3 450 000 FEET

(Joins sheet 23)

(Joins sheet 31)

Scale · 1 : 20000

1 Mile 5000 Feet

0 0 ¼ 1000 ½ 2000 ¾ 4000 1 5000

Reservoir

Stowell

DEVERS

EAST BAYOU CANAL

Bayou

Elm

SPINDLETOP

ATCHISON TOPEKA AND SANTA FE

JEFFERSON COUNTY

Be Mo FrB An Fo Fs

124 65

CHAMBERS COUNTY, TEXAS NO. 24

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and junction corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 25

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 25

3 280 000 FEET

720 000 FEET

(Joins sheet 17)

(Joins sheet 26)

710 000 FEET

(Joins sheet 32)

3 300 000 FEET

25

N

1 Mile

5000 Feet

Scale 1:20000

1405

SOUTHERN PACIFIC

CANAL

Be

LaA

LaB

Ve

Sutton Gully

HARRIS COUNTY CEDAR BAYOU

w

Mo

Fs

Ha

U.S. STEEL CORP. RAILROAD

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 26

26

N

(Joins sheet 18)

3 325 000 FEET

720 000 FEET

710 000 FEET

3 305 000 FEET

(Joins sheet 25)

(Joins sheet 33)

1 Mile

5000 Feet

Scale·1:20000

CANAL

Reservoir

PACIFIC

SOUTHERN

HILL

BARBERS

Cedar Gully

water

O.W.

McCollum Park

TRINITY BAY

LaA

Mo

Fs

Be

LaB

Ac

Ha

Ve

2354

CHAMBERS COUNTY, TEXAS NO. 26

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 27

3 355 000 FEET

720 000 FEET

(Joins sheet 20)

(Joins sheet 28)

(Joins sheet 34)

3 375 000 FEET

710 000 FEET

27

N

Scale 1:20000

1 Mile

5000 Feet

TRINITY BAY

ANAHUAC CHANNEL

TRINITY RIVER CHANNEL

Fort Anahuac Park

ANAHUAC (county seat)

CANAL

BAYOU

DOUBLE

WEST FORK

563

2936

Ha

Im

VaA

Ca

Be

Mo

An

We

28

N

(Joins sheet 21)

3 400 000 FEET

725 000 FEET

(Joins sheet 27)

710 000 FEET

3 380 000 FEET

(Joins sheet 35)

(Joins sheet 29)

1 Mile

5000 Feet

Scale 1:20000

0 0 1/4 1000 1/2 2000 3/4 3000 1 4000 5000

BAYOU

DOUBLE

FORK

WEST

CANAL

Gully

East

Bad

EAST

Reservoir

Reservoir

562

2936

2936

VaA

An

Be

Mo

Ca

Fo

FrB

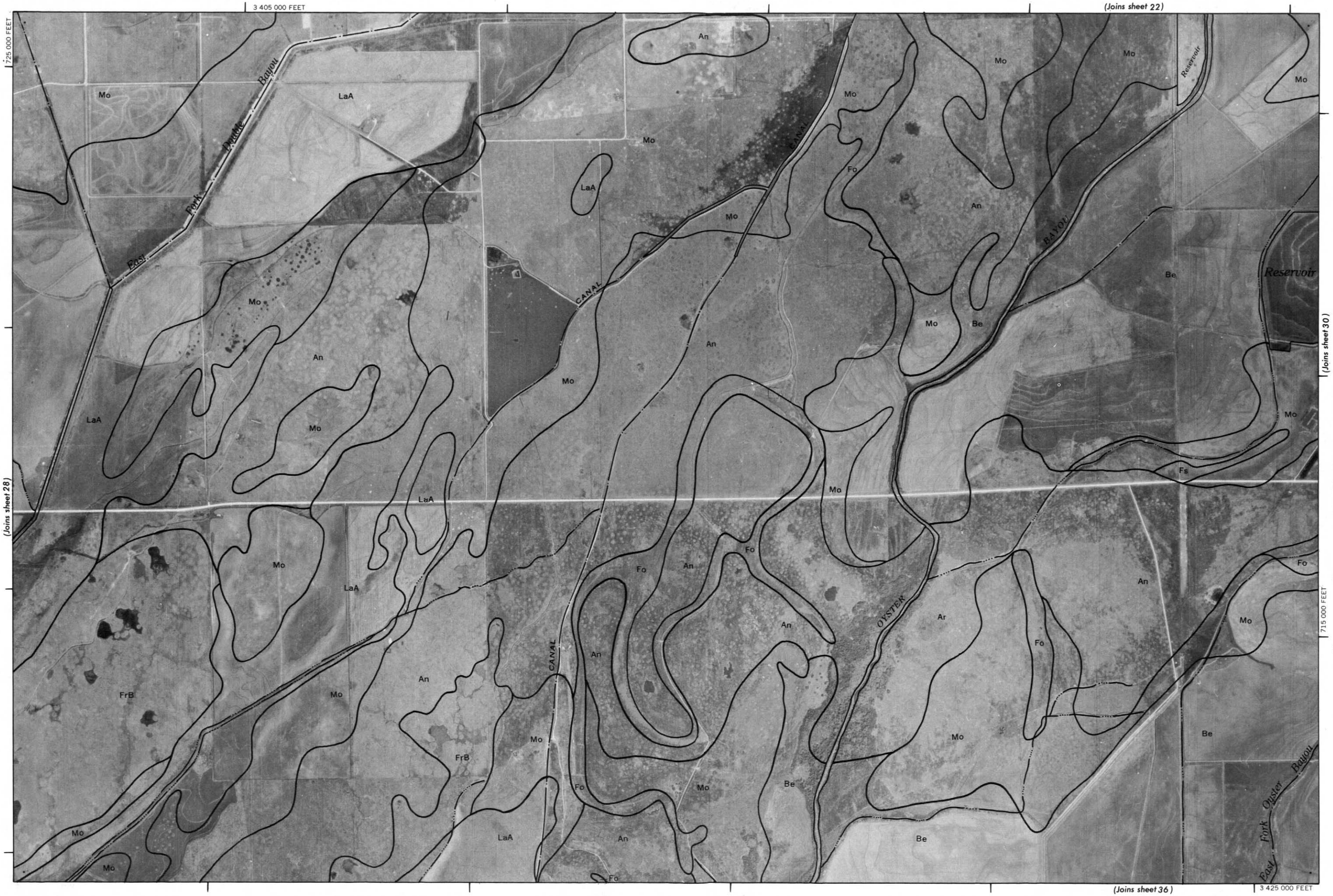
LaA

Fs

CHAMBERS COUNTY, TEXAS NO. 28

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 29



29

N

1 Mile

5000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 29

30

N

Scale 1:20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 4000

1 5000

(Joins sheet 23)

3 450 000 FEET

725 000 FEET

(Joins sheet 29)

715 000 FEET

(Joins sheet 37)

3 430 000 FEET

(Joins sheet 31)

1941

LONE STAR CANAL

DEVERS CANAL MAIN

CANAL

Bayou

Oyster

Fork

East

Bay

Reservoir

Be An Mo Fo Fs

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 30

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 31

31

N

3 450 000 FEET

725 000 FEET

(Joins sheet 24)

(Joins sheet 30)

(Joins sheet 38)

3 475 000 FEET

715 000 FEET

Reservoir

Reservoir

Reservoir

Reservoir

SPINDLETOP

CANAL

CANAL

BAYOU

ATCHISON

TOPEKA

AND

SANTA FE

DEVERS

DEVERS

EAST

CANAL

MAIN

CANAL

Elm

Bayou

East Bay Bayou

JEFFERSON COUNTY

Sea Breeze

124

124

1941

1941

Mo

Be

FrB

w

1 Mile

5000 Feet

0

0

1

5000

¼

1 000

½

2 000

¾

3 000

1

4 000

Scale 1:20000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 31

32

N

1 Mile
5000 Feet
0 0
Scale 1:20000
¼ 1000
½ 2000
¾ 4000
1 5000

3 279000 FEET
695 000 FEET
690 000 FEET
(Joins lower left)
3 274 000 FEET

COUNTY
HARRIS
ATKINSON ISLAND
Im
GALVESTON BAY

(Joins sheet 25)
3 330 000 FEET
705 000 FEET
(Joins sheet 33)

LaB
LaA
Ha
Mo
1405
U.S. STEEL CORP. RAILROAD
Devils Elbow
CEDAR BAYOU
Gully
Ijams
LaB
U.S. Steel Plant
Ijams Lake
Water
Gully
Be
Fs
2354
CANAL

HARRIS COUNTY
ATKINSON ISLAND
GALVESTON BAY

690 000 FEET (Joins inset)
3 280 000 FEET
(Joins sheet 39)

CHAMBERS COUNTY, TEXAS NO. 32

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 33

N

3 305 000 FEET

(Joins sheet 26)

705 000 FEET

(Joins sheet 32)

Be

Mo

Fs

LaA

2354

Cedar Gully Lake

Umbrella Point

(Joins sheet 39)

690 000 FEET

687 000 FEET

3 310 000 FEET

3 000 AND 5 000-FOOT GRID TICKS.

(Joins lower left)

(Joins inset)

3 325 000 FEET

695 000 FEET

TRINITY BAY

TRINITY BAY

1 mile

5000 Feet

Scale 1:20000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 33

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 34

34

N

1 Mile
5000 Feet

Scale 1:20000

(Joins sheet 27)

3 375 000 FEET

705 000 FEET

695 000 FEET

3 355 000 FEET

(Joins sheet 40)

(Joins sheet 35)

TRINITY BAY

RIVER

CHANNEL

CANAL

BAYOU

DITCH

WEST

563

Mo

VaA

Fs

Fo

Im

Be

CHAMBERS COUNTY, TEXAS NO. 34

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 35

3 380 000 FEET

705 000 FEET

(Joins sheet 28)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 41)

695 000 FEET

3 400 000 FEET

35

N

1 Mile

5000 Feet

Scale 1:20000

0 5000 1000 2000 3000 4000

¼ ½ ¾ 1

Double Bayou

Double Bayou School

WEST FORK DOUBLE BAYOU

CANAL

Bad East Gully

DOUBLE BAYOU

FORK

Chimney

Bayou

EAST

Be An Fo Fs LaA Mo St FrB SwB

36

N

Scale 1:20000

1 Mile 0 1/4 1/2 3/4 1

5 000 Feet 0 1 000 2 000 3 000 4 000 5 000

FrB (Joins sheet 29) 3 425 000 FEET

710 000 FEET

(Joins sheet 35)

695 000 FEET

3 405 000 FEET (Joins sheet 42)

(Joins sheet 37)

Mo LaA An FrB Fo Be St

CANAL

OYSTER BAYOU

Bayou

Oyster

Bayou

East

1985

CHAMBERS COUNTY, TEXAS NO. 36

This map is compiled on 1927 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 37

CHAMBERS COUNTY, TEXAS NO. 37

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 430 000 FEET

710 000 FEET

(Joins sheet 30)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 43)

3 450 000 FEET

695 000 FEET

37

N

Scale 1:20000

1 Mile

5000 Feet

LONE STAR CANAL

CANAL

Bayou

Onion

Bay

East

1941

1985

Be

Mo

Fs

An

Fo

38

N

Scale 1:20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 31)

(Joins sheet 37)

(Joins sheet 44)

3 475 000 FEET

710 000 FEET

695 000 FEET

3 455 000 FEET

Bayou

East Bay Bayou

DEVERS MAIN CANAL

Elm Bayou

Stanolind Reservoir

ATCHISON TOPEKA AND SANTA FE

DEVERS EAST CANAL

Elm Bayou

Bayou

North Prong Mud Bayou

Whites Ranch

CHAMBERS COUNTY

JEFFERSON COUNTY

1941

1985

124

Be

Mo

Fs

CHAMBERS COUNTY, TEXAS NO. 38

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 39

3 280 000 FEET

685 000 FEET

(Joins sheet 32)

(Joins inset, sheet 33)

ATKINSON ISLAND

HOUSTON SHIP CHANNEL

SHIP CHANNEL

GALVESTON BAY

TRINITY BAY

Houston Point

Camp Allen

YMCA Camp

2354

Im

LaB

Be

Ha

Mo

Fs

LaA

INSET A

3 280 000 FEET (Joins lower left)

670 000 FEET

665 000 FEET

3 285 000 FEET

INSET B

3 305 000 FEET

637 000 FEET

632 000 FEET

3 310 000 FEET

Redfish Island

GALVESTON COUNTY

(Joins inset A)

3 300 000 FEET

675 000 FEET

39

N

1 Mile

5000 Feet

Scale 1:20000

40

N

(Joins sheet 34)

3 375 000 FEET

690 000 FEET

680 000 FEET

3 355 000 FEET

(Joins sheet 45)

(Joins sheet 41)

1 Mile

5000 Feet

Scale · 1:20000

TRINITY BAY

CHANNEL

TRINITY RIVER

Oak Island

WEST FORK DOUBLE BAYOU

EAST FORK DOUBLE BAYOU

563

562

Im

Mo

VaA

Be

Fo

Ha

FrB

SwB

Fs

An

Cd

CHAMBERS COUNTY, TEXAS NO. 40

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 41

3 380 000 FEET

(Joins sheet 35)

41

N

690 000 FEET

(Joins sheet 40)

(Joins sheet 42)

680 000 FEET

(Joins sheet 46)

3 400 000 FEET

1 Mile

5000 Feet

Scale 1:20000

BAYOU

DOUBLE

FORK

EAST

Reservoir

562

Be
Fo
Mo
An
SwB
St
Fs
FrB
Ha
Cd
w

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 41

42

N

1 Mile 5,000 Feet

0 ½ ½ ¾ 1

5000 4000 3000 2000 1000 0

Scale 1:20000

(Joins sheet 36)

(Joins sheet 41)

3 425 000 FEET

690 000 FEET

680 000 FEET

3 405 000 FEET

(Joins sheet 47)

(Joins sheet 43)

1985

OYSTER Bayou East Fork

BAYOU

Reservoir

water

Be Mo An Fo FrB Ha w

CHAMBERS COUNTY, TEXAS NO. 42

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 43

3 430 000 FEET

690 000 FEET

(Joins sheet 37)

(Joins sheet 42)

(Joins sheet 44)

(Joins sheet 48)

3 450 000 FEET

680 000 FEET

1985

Be Mo Fs An Ha Fo

Onion Bayou

ONION CANAL BAYOU

water

43

N

1 Mile 5000 Feet

Scale 1:20000

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 44

44

N

Scale · 1 : 20000

1 Mile — 5000 Feet

0 — 0

¼ — 1000

½ — 2000

¾ — 4000

1 — 5000

(Joins sheet 38)

(Joins sheet 43)

(Joins sheet 49)

3 475 000 FEET

695 000 FEET

680 000 FEET

3 455 000 FEET

EAST BAY

BAYOU ELM

ATCHISON TOPEKA AND SANTA FE

Mud Bayou

Prong North

JEFFERSON COUNTY

Reservoir

water

Be

Mo

Ha

Im

w

124

CHAMBERS COUNTY, TEXAS NO. 44

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 45

3 355 000 FEET

675 000 FEET

(Joins sheet 40)

45

N

TRINITY BAY

CHANNEL

TRINITY RIVER

GORDY MARSH

LONE OAK BAYOU

GORDY MARSH

LAKE STEPHENSON

Be Mo An Fo St Cd Ha SwB PcB Ve Im water

562

(Joins sheet 46)

(Joins sheet 51)

660 000 FEET

3 375 000 FEET

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coastline grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 45

46

N

1 Mile
5000 Feet

Scale · 1 : 20000

(Joins sheet 41)

3 400 000 FEET

675 000 FEET

(Joins sheet 45)

660 000 FEET

3 380 000 FEET

(Joins sheet 52)

(Joins sheet 47)

SwB
An
Cd
Ha
Be
Fs
Mo
Reservoir
WILLOW MARSH
LAKE STEPHENSON
ROBINSON LAKE
CANAL
CANE BAYOU
ROBINSON BAYOU
water

CHAMBERS COUNTY, TEXAS NO. 46

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 47

3 405 000 FEET

675 000 FEET

(Joins sheet 42)

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 53)

665 000 FEET

3 425 000 FEET

47

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Be

Mo

Fo

Ha

Ve

w

Reservoir

Open Lakes

WILLOW MARSH

water

CANAL

OYSTER BAYOU

ROBINSON BAYOU

ANAHUAC NATIONAL WILDLIFE REFUGE

48

N

(Joins sheet 43)

3 450 000 FEET

675 000 FEET

(Joins sheet 47)

(Joins sheet 49)

665 000 FEET

3 430 000 FEET

(Joins sheet 54)

1 Mile

5000 Feet

0 0

Scale 1 : 20000

1/4 1000

1/2 2000

3/4 4000

1 5000

water

Be

Ha

Mo

CANAL

Reservoir

Coulter Island

OYSTER BAYOU

ANAHUAC NATIONAL WILDLIFE REFUGE

ONION BAYOU

ANAHUAC NATIONAL WILDLIFE REFUGE

w

CHAMBERS COUNTY, TEXAS NO. 48

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 49

3 455 000 FEET

675 000 FEET

(Joins sheet 48)

(Joins sheet 44)

(Joins inset, sheet 54)

(Joins inset, sheet 53)

3 475 000 FEET

665 000 FEET

49

N

1 Mile

5000 Feet

Scale 1:20000

0 0 0

1/4 1/2 3/4 1

1000 2000 3000 4000 5000

water

Ha

Im

Mo

w.

EAST BAY BAYOU

NORTH PROMG MUD BAYOU

WATERWAY

INTRACOASTAL MUD BAYOU

GALVESTON COUNTY

JEFFERSON COUNTY

ATCHISON TOPEKA AND SANTA FE

124

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 50

50

N

1 Mile
5,000 Feet
0
0
Scale 1:20000
¼ 1000
½ 2000
¾ 4000
1 5000

3 350 000 FEET

(Joins lower right) | (Joins sheet 51)

3 360 000 FEET

643 000 FEET

640 000 FEET

655 000 FEET

645 000 FEET

3 345 000 FEET

3 000 AND 5 000-FOOT GRID TICKS

330 000 FEET

(Joins inset)

(Joins sheet 51)

SMITH POINT

GALVESTON COUNTY

EAST BAY

TRINITY BAY

CHANNEL

RIVER

Vingt-et-un Islands

Morgan Point

Trout Point

Frankland Point

Smith Point

GALVESTON COUNTY

TRINITY

SMITH POINT

Cd Ha Ve St SwB PcB Im w. 562

CHAMBERS COUNTY, TEXAS NO. 50

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks, and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 51

51

N

3 355 000 FEET

655 000 FEET

(Joins sheet 45)

(Joins sheet 52)

(Joins sheet 50)

(Joins inset, sheet 50)

3 375 000 FEET

645 000 FEET

TRINITY RIVER CHANNEL

LAKE STEPHENSON

LAKE SURPRISE

WALLIS LAKE

EAST BAY

GALVESTON COUNTY

Stephenson Point

water

Im

Ha

Ve

Cd

SwB

St

PcB

562

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 51

52

N

(Joins sheet 46)

3 400 000 FEET

660 000 FEET

(Joins sheet 53)

(Joins sheet 51)

645 000 FEET

3 380 000 FEET

LAKE STEPHENSON

Reservoir

ROBINSON LAKE

water

Ha

Ve

GALVESTON COUNTY

EAST BAY

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Scale 1:20000

CHAMBERS COUNTY, TEXAS NO. 52

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and division corners, if shown, are approximately positioned.

CHAMBERS COUNTY, TEXAS NO. 53

3 405 000 FEET

660 000 FEET

(Joins sheet 52)

(Joins sheet 47)

(Joins sheet 54)

(Joins sheet 49)

3 471 000 FEET

660 000 FEET

655 000 FEET

3 476 000 FEET

650 000 FEET

3 425 000 FEET

Ha

Ve

w.

ROBINSON BAYOU

ANAHUAC NATIONAL WILDLIFE REFUGE

GALVESTON COUNTY

EAST BAY

GULF OF MEXICO

Frozen Point

COUNTY

GALVESTON

JEFFERSON

53

N

1 Mile

5000 Feet

Scale 1:20000

CHAMBERS COUNTY, TEXAS — SHEET NUMBER 54

54

N

1 Mile
5000 Feet

Scale 1:20000

(Joins sheet 48)

3 450 000 FEET

660 000 FEET

(Joins inset)

(Joins sheet 53)

650 000 FEET

3 430 000 FEET

Ha

Ve

w

Lone Tree Bayou

OYSTER BAYOU

Devils Elbow

ANAHUAC NATIONAL WILDLIFE REFUGE

INTRACOASTAL WATERWAY

EAST BAY BAYOU

COUNTY

GALVESTON

BAY

EAST

Im

(Joins sheet 49)

3 458 000 FEET

662 000 FEET

(Joins upper right)

657 000 FEET

3 453 000 FEET

CHAMBERS COUNTY, TEXAS NO. 54

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.